

A CRITICAL ANALYSIS OF GROUND-BASED AIR DEFENSE DURING JOINT
EXPEDITIONARY OPERATIONS

A thesis presented to the faculty of the U.S. Army
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fulfillment of the requirements for the
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MASTER OF MILITARY ART AND SCIENCE

by

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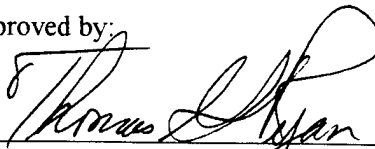
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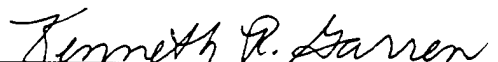
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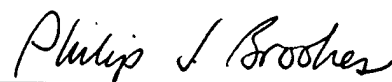
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ABSTRACT

A CRITICAL ANALYSIS OF GROUND-BASED AIR DEFENSE DURING JOINT EXPEDITIONARY OPERATIONS by Major Scott B. Frosch, USMC, 118 pages.

This study investigates the role and feasibility of ground-based air defense during joint expeditionary operations. It covers the roles and missions that ground-based air defense will fulfill during the initial thirty-day period of a lodgement operation, which is the most critical and vulnerable of times for the expeditionary forces.

This study includes the current threats from the air that a joint expeditionary force faces, the doctrine used to employ them, and their capabilities and limitations. In addition this study includes the types and amount of ground-based air defense that each of the services brings into the area of operations in the initial thirty days of the operation.

This thesis analyzes the available United States armed forces assets to protect those high-value areas and assets with the ground-based air defense assets which are brought into the theater within the first thirty days.

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CHAPTER ONE

INTRODUCTION

In the last five years the United States has won an overwhelming victory over Iraq's forces during the Gulf War, outlasted, and claimed victory in the cold war with the fall of the Berlin Wall and the dismantling of the former Soviet Union. These recent events have called into question the need for an extensive and all-encompassing military.

Although the United States armed forces have recently downsized and may again face another period of reductions in forces and equipment, the threat to the nation's vital interests has actually increased. The fallout from this recent downsizing has been a significant reduction of personnel and numbers and types of weapons of the United States armed forces. In addition to these recent events, the newly appointed Secretary of Defense Patrick J. Cohen has stated that a new period of reductions in force will once again occur in the near future.

Aggression and domestic unrest in the countries of China, North Korea, Iran, and Iraq, coupled with the increased instability of the ex-Warsaw Pact countries, have led to as unstable a world as has been seen in modern history. The proliferation of these countries' weapons of mass destruction to almost any nation that can afford them has dramatically changed how the United States must view the world. With the proliferation of these weapon systems and their technologies, there is increased interest in many nations to obtain a mass destruction capability only previously found in two or three countries in the world.

There is now the capability on the open arms markets of the world to threaten the ability of the United States to achieve and maintain air supremacy during military conflicts. The

proliferation of technologies and weapons of mass destruction will continue and is now a direct threat to every operation on a foreign shore that the United States may undertake. In addition to the fighter-bombers, helicopters, and small arms normally exported to these countries, ballistic missiles, cruise missiles, and remotely piloted vehicles have increasingly become the weapons of choice. Therein lies the problem of an ever-increasing gap between the numerous and potential threats on future battlefields and the current United State's armed forces which have undergone downsizing and may face it again in the very near future.

Ground-based air defense has been drastically reduced, since it is an expensive system to develop and to operate and has not fired at an attacking enemy aircraft in more than forty years.¹

Research Questions

The primary question is as follows: In the age of deficit reductions and a downsizing military, will the United States be able to provide adequate ground-based air defense coverage during joint expeditionary operations?

Three subordinate questions that pertain to this thesis are as follows:

1. Does the United States possess the ability to transport the desired amount of ground-based air defenses into the area of operations within the desired thirty days of deployment ?
2. Do the ground-based air defense systems currently in the United States inventory possess the capabilities necessary to counter the threat from the air to the lodgement force during the first thirty days?
3. Is the current published doctrine still viable after the latest drawdowns and the changes in the air threat found in the world today?

Purpose of the Study

This thesis conducts an analysis of ground-based air defense during joint expeditionary operations. It determines whether or not the ground-based air defense capability of the United States armed forces have been downsized to the proper level. In order for the of the United States armed forces to be able to conduct expeditionary operations in the world of today, the forces must be protected from the constant and prevalent air and missile threat. The forces that are deploying into a lodgement area must be assured that they will be protected from the air and missile threat during the first thirty days of the operation. The air defenses sent to protect the joint expeditionary force must be properly trained and should have a sufficient amount and mix of ground-based air defense weapons to meet the threat. The first thirty days are significant, for the buildup of forces in the lodgement area is most critical during this period.

This thesis focuses on four main areas of research:

1. The amounts, types, and capabilities of threat aircraft, unmanned aerial vehicles, and missiles that the U.S. armed forces will face in a expeditionary operation;
2. The amounts and types of airlift and sea lift that will move the lodgement force into the area of operations within the first thirty days;
3. The amounts and types of assets that the Joint Force Commander will require to be protected by an ground-based air defense umbrella; and
4. The amounts, types, and capabilities of ground-based air defense systems that will likely be projected into the lodgement area within the first thirty days to provide the required air defense for those assets designated by the Joint Force Commander.

Significance of the Study

This research helps solve a fundamental problem facing the United States armed forces and the air defense community as a whole: although the Soviet Union is just a shadow of its

former self, the air threat in the Central Eastern European (CEE) countries is still viable. A need exists to plan against these future capabilities and not just the current intentions of the countries that possess them.

The countries and satellites of the Commonwealth of Independent States (CIS) are now struggling with the concept of democratization, a failing economic base, and a call for a return to the communist way of life. The end result of this breakup of the former Soviet Union is an increased instability which did not exist when control of this arena was under the influence of the bipolar forces of the cold war.

With its own debt increasing in size almost daily and lacking in working capital, Russia and the CIS are now selling weapons and technologies to the highest bidder, which until a few years ago had been in limited supply and high in demand. In addition to the export versions of fighter-bombers, helicopters and small arms, short- and long-range ballistic missiles, cruise missiles and unmanned aerial vehicles are now finding their way to the international arms markets in significant numbers.

In addition to these factors, there is an increase in the number and frequency of low-intensity operations. In a world where 73 percent of the surface is covered by water, with over 70 percent of the world's populations living or moving within 250 miles of these bodies of water, these littoral regions of the world are now considered by the Department of the Navy to be the next likely arena for a future conflict.

Low- or medium-level intensity operations conducted within the littoral regions, coupled with the proliferation of ballistic and cruise missiles, will pose an extremely volatile battlefield for a country unprepared to counter this combination of threats. The concepts of amphibious or lodgement operations will begin to take on an all new importance for those that thought that the United States would never again have to fight its way into an operation area from the sea or air.

The concepts of expeditionary operations in a low- or medium-level operation and the protection of that joint force from air or missile attack are examined in detail to determine whether or not the United States will be able to protect the force and to project combat power ashore when and where required. This thesis covers, but is not limited to, the current United States ground-based air defense weapons, tactics of employing these systems, and the amount or type of vital areas or interests doctrinally protected.

Assumptions

1. The numbers of cruise missiles, unmanned aerial vehicles, and tactical ballistic missiles will continue to increase due to their relatively low cost, increased capabilities, and relative ease with which they can be purchased on the open arms market.
2. With the greater number of cruise missiles, unmanned aerial vehicles, and tactical ballistic missiles found in those countries that have purchased them, they will likely have the mind-set to use them more. The reason for this belief is that to use fighter-bombers and helicopters in battle, factors, such as fear or loss of human life, will play into their employment and use, a consideration which does not have to be given to the employment of these new weapons of mass destruction. These new weapons also bring many cost effective benefits with their purchase: no pilots have to be trained, or their expensive aircraft maintained; these weapons have long-range capabilities, great accuracy, and do not fear the loss of their life flying against the overwhelming air forces and air defense forces of countries, such as the United States. When these factors are compounded with the current instability of the world, the likelihood of use increases dramatically.
3. The United States will continue to downsize the armed forces due to a declining budget, and one of those areas to take significant cuts will be that of ground-based air defense.
4. The current air defense principles and guidelines as listed below are still viable.

Air Defense Principles

Mix. Weapons mix offsets the limitations of one air defense system with the capabilities of other air defense systems. Defending an asset with the proper mix of air defense weapons complicates the enemy's strategy. An effective mix of air defense weapons forces the enemy pilots to defend themselves against several types of air defense weapons in order to accomplish their missions.²

Mass. Weapons mass is achieved by allocating sufficient air defense resources to defend successfully the priority assets.³

Mobility. Mobility permits military forces to move from place to place while retaining the ability to fulfill their primary mission. Air defense systems must be highly mobile and rapidly deployable to provide continuous protection for maneuver elements and to provide for their own survival.⁴

Integration. Integration is the close coordination of effort and unity of action which results in the most efficient use of each of the individual air defense systems within the total air defense plan. The result of proper integration is the conservation of air defense fires by eliminating unnecessary multiple engagements of the same target by different air defense units.⁵

Air Defense Guidelines

Balanced Fires. Balanced fires are achieved by positioning air defense units to permit approximately equal defensive fires in all directions. Balanced fires take on added importance when facing a 360-degree threat.⁶

Weighted Coverage. Weighted coverage is achieved by concentrating air defense weapons toward known enemy locations, unprotected unit boundaries, or likely enemy attack corridors or routes.⁷

Mutual Support. Mutual support is achieved by positioning individual fire units so that effective fires can be delivered into the dead zone that surrounds an adjacent fire unit. Mutual support enhances the survivability of all air defense assets.⁸

Early Engagement. Air defense systems should be positioned far enough from the asset or unit being defended to permit the engagement of an enemy aircraft before ordnance release. The enemy's ordnance release line (ORL) will vary with the type of aircraft and ordnance employed. When developing air defense plans, actual threat tactics, flight profiles, and ordnance capabilities must be considered.⁹

Overlapping Fires. Air defense systems are normally positioned so that the engagement zone of one air defense system overlaps with the engagement zone of adjacent systems.¹⁰

Defense in Depth. Defense in depth is achieved by positioning air defense fire units so that enemy aircraft encounter an ever-increasing volume of fire as they approach a specific defended asset or area. Defense in depth is maximized by integrating all air defense weapons used in the defense.¹¹

Definition of Terms

There are numerous definitions that will be used during the conduct of this thesis. The significant definitions are listed below:

Adequate. For the purpose of this thesis, when discussing adequate air defense coverage, it will refer to protecting those assets, either military or geopolitical in nature, that are determined critical by the Joint Force Commander.

Amphibious Operations. An attack launched from the sea by naval and landing forces, embarked in ships or craft involving landing on a hostile shore. As an entity, the amphibious operation includes the following phases: planning, embarkation, rehearsal, movement, and assault.¹²

Area of Operations (AO). That portion of an area necessary for military operations and for the administration of such operations. A geographical area, usually defined by lateral, forward, and rear boundaries, assigned to a commander by a higher commander, in which he has the responsibility and the authority to conduct military operations.¹³

Base Defense Zone (BDZ). An air defense zone established around an air base and limited to the engagement envelopes of the defending weapons systems. BDZs have specified entry, exit, and Identification Friend or Foe (IFF) procedures which aircrews must follow.¹⁴

Battle Command. The art of battle decision making, leading, and motivating soldiers and their organizations into action to accomplish missions. Includes visualizing the current state and future state, then formulating concepts of operations to get from one to another at the least cost. This includes assigning missions, prioritizing and allocating resources, selecting the critical time and place to act, and knowing how and when to make adjustments during the fight.¹⁵

Deployment Day (D-Day). The first day forces conduct actual deployment into a theater of operation or launch a specific attack during a particular operation.

Expeditionary Force Operations. An armed force organized to accomplish a specific objective in a foreign country.¹⁶

Fighter Engagement Zone (FEZ). That area of the three-dimensional battlefield that is dedicated to being protected by the air defense fires of aircraft-based systems only.

Joint. Connotes activities, operations, organizations, etc., in which elements of more than one service of the same nation participate. When all services are not involved, the participating services shall be identified, for example, joint Army-Navy.¹⁷

Littoral Operations. Those military operations that will take place within 250 miles of the coastline of a country or continent. These operations are initially amphibious or helicopter borne in nature.

Missile Engagement Zone (MEZ). That area of the three-dimensional battlefield that is dedicated to being protected by the air defense fires of ground-based systems only.

PAC-2 Patriot Missile. The initial Patriot Missile which was deployed with the United States Army into Operations Desert Shield and Desert Storm. Originally designed to meet a fixed-wing and helicopter threat, it was later updated to engage tactical ballistic missiles.

PAC-3 Patriot Missile. An upgraded version of the PAC-2 Patriot missile which has been specifically designed to engage tactical ballistic missiles. This new missile which is currently undergoing fielding tests and evaluations and is scheduled to be fielded in the operational Army air defense units in 1999.

Short Tons (STONS). The amount of equipment or supplies shipped or moved as expressed in short ton. The short ton is the equivalent of .907 metric ton, and is the standard expression used by the United States military when describing assets to be transported during exercises and combat operations.

Weapons Free. In air defense, a weapons control status used to indicate that weapons systems may be fired at any target not positively identified as friendly. It is executed within the rules of engagement.¹⁸

Weapons Hold. In air defense, a weapons control status used to indicate that weapons systems may be fired only in self-defense or in response to a formal order. The Weapons Hold status is normally time, area, or unit limited as to classification of aircraft to be protected (e.g., Low Altitude Air Defense Weapons Hold, 1600-1700, area D, jets).¹⁹

Weapons Tight. In air defense, a weapons control status used to indicate that weapons systems may be fired only at targets identified as hostile. Executed within the limitations of the Rule Of Engagement (ROE).²⁰

Delimitations

1. This thesis only considers current threat capabilities of fielded weapons systems found within the world.
2. This thesis is limited to the current capabilities of the fielded weapons and transportation assets within the United States armed forces.
3. This thesis only considers the first thirty days of a joint expeditionary operation. This will be defined as D-Day; being the day that the first combat U.S. forces are deployed to the area of operations.

Limitation

The primary limitation of this thesis is a lack of published joint doctrine on the employment of ground-based air defense during expeditionary operations, coupled with the fact that there are differences in doctrine within each military service regarding the employment of their specific ground-based air defense weapons systems.

Thesis Structure

To answer the question of this thesis, the research examined the abilities of the United States armed forces to deploy quickly by organic airlift and sea lift to the area of operations and deploy a comprehensive and effective ground-based air defense umbrella over the joint force and its vital assets.

Chapter one provides background for the thesis question, purpose and significance of the study, and definitions of terms important to the study. This was done to set the criteria for how the thesis would be conducted and to establish a guideline to follow on how the outcome of the analysis was established.

Chapter two is a review of the current literature and related studies to the thesis question. Books, field manuals (FMs), Fleet Marine Force Field Manuals (FMFMs), periodicals, articles, and compact discs that are related to the study of ground-based air defense and expeditionary operations are sources that are found in this chapter.

Chapter three discusses the research methodology used during the conduct of this thesis. This thesis will use a combination of two types of research methodology: the comparative approach to conducting the research and an examination of two case studies looking at Guadalcanal and the Solomon Islands Campaign of 1942-1943 and operations Desert Shield and Desert Storm during 1990 and 1991.

Chapter four presents the analysis of the information that was uncovered during the review of the literature and through the research methodology and the evaluation of the case studies that were conducted during chapter three.

Chapter five will contain the conclusion of the thesis and any recommendations for the future employment of ground-based air defense systems during joint expeditionary operations, to include possible changes in doctrine. The changes in doctrine may fall into any one of the following five areas: doctrine, training, leadership, organization, or material improvement.

¹U.S. Army, Air Defense Artillery Museum, *A Pocket History of Air Defense Artillery*, (El Paso: U.S. Army Air Defense Artillery Museum, 1996), 14.

²U.S. Marine Corps, FMFM 5-52, *Employment of the Low Altitude Air Defense Battalion* (Washington: Headquarters, United States Marine Corps, 1990), 5-15.

³Ibid.

⁴Ibid.

⁵Ibid.

⁶Ibid.

⁷Ibid.

⁸Ibid.

⁹Ibid.

¹⁰Ibid., 5-18.

¹¹Ibid.

¹²U.S. Marine Corps, Fleet Marine Force Field Manual 1-2, *The Role of the Marine Corps in the National Defense* (Washington: Department of the Navy, 1988), C-2.

¹³U.S. Army, FM 100-5, *Operations* (Washington: Department of the Army, 1993), Glossary-0.

¹⁴U.S. Marine Corps, Student Handout CWTI 00383, *Airspace Management* (Yuma: Marine Air Weapons Tactics Squadron-1(MAWTS-1), 1992), 6.

¹⁵FM 100-5, Glossary-1.

¹⁶FMFM 1-2, C-5.

¹⁷Ibid., C-6.

¹⁸U.S. Marine Corps, Student Handout CWTI 00332, *Weapons Systems Management* (Yuma: MAWTS-1, 1992), 9.

¹⁹Student Handout CWTI 00332, 9.

²⁰Ibid.

CHAPTER TWO

LITERATURE REVIEW

This chapter examines the literature currently available to assist in the research of this thesis. This thesis used numerous publications from a variety of sources dealing with the employment of a particular weapon system and with the doctrinal use of that weapon system during sustained combat operations. In addition, publications on transportation, expeditionary operations, and the proliferation of new weapons by belligerent nations were used. Unfortunately, it was impossible to locate a substantial document or publication that combined these aspects into a single publication which could be examined by a joint force commander before planning for and deploying into a joint expeditionary operation.

No major publication on the subject of the employment of ground-based air defense during joint expeditionary operations was located for use as a basis for this thesis. It is a contention of this thesis that a deficiency exists in the military's current publications dealing with this particular subject. This lack of a study on the capabilities and limitations of ground-based air defense during joint expeditionary operations is why this thesis was written.

The literature review was broken down into the following categories: joint publications from the Joint Chiefs of Staff (JCS Pubs), Department of Defense (DOD) reports, U.S. General Accounting Office (GAO) reports, U.S. Army publications, U.S. Marine Corps publications, U.S. Air Force publications, and civilian reports and publications. This review does not contain an analysis of every publication used or listed in the bibliography but discusses those which had an impact on the outcome of the research conducted during the course of the thesis.

Joint Publications

JCS PUB 3-01.5, *Doctrine for Joint Tactical Missile Defense*. The U.S. Department of Defense publication describes the joint tactical missile defense doctrine currently used by the United States armed forces. This report was used during the conduct of the thesis for substantiation of the need to conduct joint tactical missile defense during joint expeditionary operations.

Department of Defense Reports

Theater Missile Defense Report to Congress was completed in 1991, almost immediately after the end of the Gulf War. This report claimed to the Congress of the United States that the intercept ratio of the Patriot missile during the Gulf War against the Scud missile was 96 percent, when the actual intercept ratio was closer to 4 percent for warhead on warhead kills. In addition to this apparent error, it appears that other data cited may have been skewed to some extent by a combination of other factors. This report is useful in determining many factors. However, it can also be seen as proof of what can happen when the wills of the defense contractor and its using service try to put a good light on a particular weapon system. This overstatement of the actual kill ratio should not be taken as a fault of the current Patriot weapon system, for it was not initially designed to protect the ground forces from a tactical ballistic missile threat.¹ The mission of protecting the ground forces from attack by tactical ballistic missiles was pushed upon the weapon system after its initial design and production, and this topic will be addressed at length in chapter four.

Support of Operation Desert Shield/Desert Storm, written by the United States Transportation Command a year after Operations Desert Shield and Desert Storm, this report is quite extensive in scope and appears to be accurate in most instances. The facts and figures cited by this report are generally in line with those given in the Air Mobility Command's report to

Congress which was published the next year. This alignment of facts and figures may be a coincidence or a reflection that this report may have been a basis for the air mobility report, but the shipments of cargo given in numbers of STONS transported and dates of arrival in Southwest Asia, are basically the same as those found in other publications and reports on this subject. This report was useful in helping establish the numbers of aircraft and shipping which are needed to move a force the size of the one deployed to Operations Desert Shield and Desert Storm.

U.S. General Accounting Office Reports

Desert Shield and Storm Air Mobility Command's Achievements and Lessons Learned for the Future. This report was completed in 1993, appears to be quite extensive and accurate in its appraisal of the capabilities and limitations of the Air Mobility Command during Operations Desert Shield and Desert Storm. The limitations of the United States Air Force brought forward during the investigation of the deployment to the South West Area of Operations during 1990 and 1991 are quite extensive and revealing. The limitations and drawbacks of the Air Mobility Command are brought out in the number of STONS expected to be delivered and the actual number that made it to the area of operations due to numerous problems. These problems included pilots exceeding the number of flight hours without crew rest, numbers of aircraft that could not make scheduled runs due to lack of parts, and breakdowns in the command and control structure within the Air Mobility Command. This publication was enlightening in that it also shows that the ability of the United States Air Mobility Command will actually decrease in the near future, until the arrival of substantial numbers of the new C-17 transport aircraft. This downsizing of strategic airlift and the subsequent gap in time before the C-17 is deployed in large numbers have an immediate impact on the ability of the United States to project combat power abroad. This inability to efficiently and effectively transport the military in a timely manner will

be seen by other nations as a weakness until such time as the airlift capability comes back up to a respectable level.

Report to the Chairman on Governmental Affairs, U.S. Senate-Ballistic Missile Defense, Evolution and Current Issues. Published in 1993, this report addresses the ability of the United States armed forces to defend against the ballistic missile. Although this report does not always address the tactical ballistic missile and focuses primarily on the strategic use of the ballistic missile, it does have information on the current capabilities of the Patriot missile system when armed with the PAC-2 missile. This information may be somewhat optimistic in its revelations, but is some of the best unclassified material that could be found on the subject.

United States Army Publications

A Pocket History of Air Defense Artillery. Published by the United States Army Air Defense Museum in 1993, this reference handbook is fairly encompassing in scope, and extremely interesting reading. This reference describes the history of ground-based air defense from 1917 to the present. The information presented is accurate in the description and capabilities of the weapons it includes, as well as the units that manned these weapons during the conflicts where ground-based air defense has been employed. Although somewhat compressed in size, a more knowledgeable account of the history of air defense artillery has not been found.

FM 44-1, *U.S. Army Air Defense Artillery Employment.* This field manual contains the doctrinal applications for the employment of ground-based air defense systems of the United States Army. The air defense principles and guidelines found within this text are used by the other armed forces of the United States, as well as approximately forty nations throughout the world. The air defense principles and guidelines found within this manual will be used during the course of this thesis.

U.S. Army Air Defense Artillery -Quick Reference Handbook. This reference book was published in 1995 and is an up-to-date reference for the current structure and weapons systems of the air defense branch of the United States Army. This handbook was extremely helpful in understanding the size and structure of air defense units of the United States Army. In addition to these applications, this reference has one new aspect involving the air defense community that was not found anywhere else, that of air defense during operations other than war. This area was enlightening in the aspect that the role of ground-based air defense during operations other than war was not listed or referred in any other publication. The ability of air defense to protect a humanitarian effort, during the course of a Non Combat Evacuation Operation (NEO), has been discussed, but this is the first time in which it has been located in a publication.

FM 44-15, *Patriot Battalion Operations*. This publication is important in that it discusses in detail the tactical employment of the Patriot air defense system. The actual tactical employment and the considerations are listed and discussed as well as the capabilities and limitations of the weapon system itself.

United States Marine Corps Publications

FMFM 5-52, *Employment of the Low Altitude Air Defense Battalion*. This Fleet Marine Force Manual is the Marine Corps version of the Army FM 44-41. The manual is based upon the Army version and at times could be considered a copy in some aspects. The manual covers the basic air defense principles and guidelines as discussed in chapter one. In addition the manual also covers how the Marine Corps differs in some aspects of employment for short-range air-defense systems from those of the Army. The aspects of early warning and communications are also discussed, as well as the capabilities and limitations of the Stinger weapon system itself. This manual was very informative and useful; an encompassing piece of doctrine, that was quite helpful in the scope of this thesis.

CWTI 00 Series, *Command, Control, and Communications Syllabus*. This series of doctrinal publications is published by the Weapons and Tactics Instructors School, which is held by the Marine Aircraft Weapons Tactics Squadron-1 at Marine Corps Air Station, Yuma, Arizona, on a biannual basis. This combined-arms school emphasizes the employment of aircraft, ground-based air defense weapons, and artillery under a set command and control system. This school teaches approximately one hundred students per class, mostly from the pilot, air defense, artillery, and infantry military occupation specialties (MOSs), and representatives from all of the other armed forces.

The curriculum guides are an enormous wealth of doctrinal information that are used to teach the use of airpower in a combined arms environment to the company and field grade officers of the Marine Corps and other services. These guides and student texts, which comprise the greater part of the CWTI series were used liberally throughout this thesis. Given the fact that a weapons and tactics school published this series written by the Marine Corps should not distract from the fact that these texts are probably the most comprehensive works found concerning the employment of combined arms in a joint environment.

Up the Slot: Marines in the Central Solomons. This publication was written in 1993 as one of the Marines in World War II Commemorative Series for the History and Museums Division, Headquarters Marine Corps, as part of the United States Department of Defense observance of the fiftieth anniversary of victory in that war. This pamphlet was researched and written by Major Charles D. Melson, USMC (retired). The pamphlet covers the period from early 1943, directly after the Marine Corps began its withdrawal from Guadalcanal, and goes up to the time frame of early 1944. This pamphlet was used extensively during the research for the central Solomons campaign, for it was the most thorough information that was found on the campaign as a whole. In addition, it appears that the author of the pamphlet spent an extensive

amount of time on the role of the ground-based air defense during these operations and in particular, on the role of the Marine Defense Battalions during the initial landings and defenses of the lodgement areas. The research also contains a great number of personal accounts of the Marines who were conducting the landings, and once again, particular attention is paid to the roles of the antiaircraft artillerymen in these operations. The only drawback of this pamphlet was that it did not contain the battle for Guadalcanal itself; this information had to be obtained by other venues.

United States Air Force Publications

Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War.

Published directly after the Gulf War, this publication deals mostly with the employment of airpower during the war from 17 January 1991 to its end on 28 February 1991. However, there exists some pertinent data on the Air Force's role in the transportation of the forces into the Southwest Asia area of operations in this report. This information is almost the same in context as that found in the reports of the Air Mobility Command and United States Transportation Command (USTRANSCOM), which lends to the credibility of the majority of this information. The information found within this document was important and helped in the correlation of facts when researching the air transportation capabilities of the United States.

Civilian Publications

This area of the literature review is broken down into categories of books, periodicals, and articles. The civilian publications that are used during this thesis were for the most part written directly after the conclusion of the Gulf War.

Although the periodicals are extremely up to date for the time that they were written, some of the weapons engagement accomplishments that were initially published as fact have

since been proven to be an overestimation. This overestimation is to be expected to some extent, and in particular is prevalent in each of the service's individual professional journals. Having read a number of these professional journals from each of the services, it can be said that each seems to claim to have the best doctrine, weapon system, or organizational structure to handle the particular problem given in that article. This type of disinformation is unfortunate, in that the purpose of these types of journals was originally supposed to have been as a form of self-examination and reflection, for the improvement of the organization involved. The reason that this type of critique is brought out in the literature review is to explain why some forms of literature, such as independent studies or General Accounting Office reports, may be used more than other types of publications.

In the category of books, there was found to be a more unbiased approach to the research, in that although prejudices against one weapon system or service may have been found, it was usually less prevalent, and both sides of the issue were reviewed. In particular, when reviewing a series of books, such as those dealing with foreign policy or on governmental arms purchasing, a particular weapon system or service was not usually protected from scrutiny. This unbiased approach made this type of source invaluable when looking at how these systems made it to the battlefield and at why some early reports of exaggerated or overestimations in success rates were written as they were.

Although it may sound as if the services' professional journals and civilian sources were discounted during the research of this thesis, this could not be further from the truth. The professional journals and some civilian publications making overestimations or exaggerations in some stories were viewed during the course of this thesis as an unavoidable hazard, but one that was distinguishable after studying other documents on the same subject. The fact remains that the professional journals serve an important function in today's military and were used during

the course of this thesis for reference and personal accounts and opinions, for which these publications are well know.

Books

Archie, Flak, AAA, and SAM. This book was written by Dr. Kenneth P. Werrel during his time while serving as a visiting professor at the Air University Center for Aerospace Doctrine, Research, and Education (AUCADRE) at Maxwell Air Force Base, Alabama, in 1988. A former Air Force officer, and graduate of the Air Force Academy, he is currently a professor of history at Radford University in Virginia and a visiting professor at the United States Air Force Command and General Staff College. This book is extensively researched and most informative for researching the capabilities and limitations of the ground-based air defense systems during the period leading up to World War II and the war itself. The guns and radar systems that were used during the central Solomons campaign were discussed in this book, information that was near impossible to be found in other resources. For these facts alone, this book alone stood as a good source; however, it was extremely limited in its coverage of the war in the Pacific during World War II. Thus this information had to be obtained through other sources.

Crusade. This book was written in 1993 by Rick Atkinson about the Gulf War and all of the controversies that surrounded this time in world history. The book covers all the aspects of the war from the launching of the air campaign to the ground war and was very useful in determining how the United States Central Command (CENTCOM) under General H. Norman Schwarzkopf, met the challenges of the Scud missile. This information was insightful in that it provided firsthand accounts of the discussions and arguments which happened in the CENTCOM war room deep under Riyadh, Saudi Arabia, in 1990 and 1991. In addition, this book also covers the futile attempts by the Special Operations Forces (SOF) of both the United States and Britain to locate and destroy the Scud missile batteries from the ground. The insight gained through this

book on the SOF and Special Air Service (SAS) forces attempts was a matter of speculation for a number of years, but this was the first time in this detail that it was printed for the masses. The one drawback found with this book was the fact that it only covered the movement of forces into the theater on a haphazard basis, and since this was not covered more thoroughly, other resources had to be found.

Guadalcanal. This book was written by Edwin P. Hoyt and published in 1982. It covers the Guadalcanal campaign from its conception in the Department of the Navy and Department of War and follows it through to the end of the campaign. The book covers the details of the campaign more from the strategic and operational aspects than it does from tactical. The amount of information on how the campaign was designed, and how the forces were to be used is useful, but lacking on the actual tactical employment of these forces. The book used very few personal accounts of how the ground forces came ashore and to what extent the commanders placed an emphasis on their defense against the enemy air attacks. However, it was useful in accounts of the numbers of Japanese aircraft attacks and the damage that they inflicted upon the lodgement forces.

Guadalcanal-Starvation Island. Written by Eric Hammel in 1987, this book was used as a supplement to the Hoyt book for the case study into the central Solomons campaign. It was interesting reading of numerous personal accounts of the battle, and it contained useful information on the ground schemes of maneuver which were lacking in the Hoyt book. The book was useful for the Guadalcanal campaign and included accounts of the ground-based air defense unit's fight against the Japanese air attacks during the early lodgement period.

Missile Defense In The 21st Century: Protection Against Limited Threats-Including Lessons From The Gulf War. The majority of the information drawn from this book was on the proliferation of tactical ballistic missiles throughout the world. In addition to this information,

the book was extremely detailed in the capabilities and limitations of almost every theater ballistic missile (TBM) openly known to the world at this time.

Regional Security and Anti-Tactical Ballistic Missiles: Political and Technical Issues.

A comprehensive and technically oriented publication on the abilities of TBM defenses written with a physicist's based approach. This book proved to be invaluable in interpreting the amount of actual coverage which could be realistically expected, vice those which were advertised by the producing corporation.

The Second World War: Asia and the Pacific. This book was written for the United States Army by John Miller, Jr., to be included in the Historical Division of the Department of the Army series: The War in the Pacific. Although written in 1949, this book was the most extensive in detail that could be found on the Guadalcanal campaign. The precise listings of units which participated in the landings and in the subsequent defense of the lodgement area was unmatched by any other text found. The day-by-day accounts of the initial landings and of the buildup of combat power ashore were in infinite detail, even at times listing the commanders of the units down to the squad detail. This amount of detail was also afforded to the research of the Marine Defense Battalions which were the primary ground-based air defense units during this campaign. In addition, the detail also included the weapons and radars of these battalions, and how and where they were emplaced. The maps and firsthand accounts that accompanied them were the vital thing missing from the majority of the other texts on this battle. This book proved extremely useful during the course of the research into the Guadalcanal campaign.

The War in the Pacific-Guadalcanal: The First Offensive. A comprehensive book on the war in the Pacific and Asia theaters written by Lieutenant Colonel John H. Bradley, USA, and Major Jack W. Dice, USA, during their time at the Department of History, United States Military Academy, in 1977. This book offered an insight into both the American and the

Japanese side of the conflict. The scope is that of a historical text and does not contain personal accounts, although it was revealing in the discussions of the Marine preparations for landings into the Solomon Islands and therefore proved useful in the review of the Japanese order of battle for the Solomons campaign.

Triumph without Victory-The Unreported History of the Persian Gulf War. This book was written by 1992 in conjunction with U.S. News & World Report. The content is written to reflect a personal view of the war through interviews with the soldiers, Marines and airmen who served in the Southwest area of operations. The book does give first-person accounts from the personnel of A Battery, 2nd Battalion, 7th Air Defense Artillery Regiment that did reveal facts that were unknown to this author and were quite helpful during the course of this thesis. The personal accounts are, of course, just that, personal views on what one individual saw or thought he saw on the battlefield, but nonetheless these accounts are extremely valuable. In particular this book reveals facts about the Patriot system that were not mentioned previously in other publications, mostly dealing with the aspects of the maintenance cycle which needed to be adhered to during operations. In addition it also shows which Patriot batteries were operational, and shows at what times in the battle they were shut down for maintenance. This information on the maintenance cycle was pertinent when determining how many batteries of Patriot will be needed to provide continuous twenty-four-hour protection for a vital asset.

Periodicals

Jane's Defense Weapons. This publication proved to be the cornerstone of listings on the capabilities and limitations of every weapon system that was covered during the course of this thesis. The information given in this publication is unclassified in nature, and some discrepancies could be noted, but for the most part these were but an insignificant percentage of the true range or speed of the weapon. In addition, the characteristics of each of the weapons

was presented in a unbiased format which appears to be more realistic in review than were some of the reports from the early days of Operations Desert Shield and Desert Storm.

Army/Navy/(Marine Corps Edition) Times. These publications were very interesting reading and extremely up to date in nature. However, the articles were at times inaccurate and tended to be written before the facts were uncovered. The majority of the articles were not used as a reliable source, although some personal accounts were taken from its pages. For the most part, this type of publication was used very sparingly in the course of the research for this thesis.

Other Publications and Articles. Other publications used during the course of research for this thesis are fully listed in the bibliography of this thesis.

¹U.S. Army, Air Defense Artillery Museum, *A Pocket History of Air Defense Artillery*, (El Paso: U.S. Army Air Defense Artillery Museum, 1996), 12.

CHAPTER THREE

RESEARCH METHODOLOGY

During the course of conducting the research for this thesis, a combination of two types of research methodology were used: the comparative approach and two case studies. The comparative approach is the analysis of the data gathered to determine if the evidence supports the expected outcome of the thesis. As an example, this approach was used to determine if the number of aircraft, with their particular ability of lift, could transport the number of STONS required for an operation to a particular area of operations. This particular approach was used extensively, especially when dealing with areas that relied heavily on mathematical analysis. The case studies in part help determine which assets of the expeditionary commander would be determined as critical for coverage by ground-based air-defense assets, and in historical terms how long it took a force to deploy into an area of operations.

This chapter will be broken down into three parts: the first which will consist of the problems encountered in the research of this thesis, the second follows with a review of researching the two case studies, and the third will show how the comparative approach was used to help in determining particular mathematical probabilities.

Problems Encountered During the Conduct of the Research

During the course of this thesis no significant problems were encountered; however, one minor problem did exist. The most difficult information to obtain was the deployment data on the movement of the United States Army's 11th Air Defense Artillery Brigade. This information

is key in determining how long a Patriot brigade took from the time of initial notification of alert to actual deployment. The after-action report for this time frame is also critical, for it will contain the exact number of aircraft that were used to lift the brigade to Saudi Arabia in the fall of 1990. Initial phone calls were placed to the 11th brigade in August of 1996 to acquire this information, with assurances that this information was in their possession, and that it would be forwarded as soon as possible. After approximately twenty phone calls and assurances of the reports impending mailing to the Command and General Staff College at Fort Leavenworth, the determination was made that the report would not be forward for the completion of this thesis. At this point, which occurred in early December, 1996 the Center for Army Lessons Learned was able to produce what the originating command could not, and the research continued to progress after this incident. With this one exception, no major difficulties were encountered.

Case Study Reviews

The two case studies evaluate the impact on the commander and the transportation assets of deploying an expeditionary force abroad which was subjected to attack from the air. The two case studies used during the course of the research for this thesis are those of the operations on Guadalcanal and in the Central Solomons during World War II and Operations Desert Shield and Desert Storm.

The operations of the Central Solomons campaign during 1942 and 1943 were selected as one of the two case studies because this expeditionary force was subjected to attack from the air numerous times during the first thirty days of the individual operations. The air attacks were conducted continuously by the Japanese Air and Naval Air Forces in conjunction with attacks by their ground and naval forces.¹ The combined effects of these attacks were examined, as well as the thought process of the operational commander in the selection of assets for priority of air defense. Although the invasion of the Solomon Islands took place over fifty years ago, much can

be learned from the trials and tribulations of the expeditionary force in the attempt to project their combat power ashore under a combination of naval, ground, artillery, and air attacks.

The case study of Operations Desert Shield and Desert Storm is separated into the following areas: Analysis of the deployment and buildup of combat power into the Southwest Asian Area of Operations during a modern day expeditionary operation was one of the areas examined from Operation Desert Shield. In addition, the thought process used by the operational commander in his selection of assets for protection by air defense assets is the second emphasis in the examination of Operation Desert Shield. The particular process may be difficult to ascertain; however, something can be learned from how the operational commander selected assets to be protected. The selection of which targets should be chosen for protection in a politically charged environment, such as occurred in Saudi Arabia, and the region during this period was of great benefit.

Although Operation Desert Storm did not begin within thirty days of deployment of U.S. forces into the Area of operations, it was examined, due to the fact that it is the only time in recent history that U.S. forces have come under attack from the air. The capabilities of the Patriot missile system during combat operations were examined to ascertain the amount of problems which came to light and which were not found during the use of the system during exercises or controlled live-fire shoots. In addition, Operation Desert Storm was examined to understand the strategic, operational, and tactical implications of conducting combat operations during a multinational operation of this magnitude, which would influence the air defense priorities of the operational commander. Last, Operation Desert Storm will also be used to research the capability of the joint expeditionary force to conduct air defense operations against the aircraft, unmanned aerial vehicles, and tactical ballistic missiles which were launched against the coalition forces during the course of the war.

Comparative Approach

This approach was used to conduct a comparison of the numbers, capabilities, and limitations of the different types of ground-based air defense systems that are found within the United States Armed Forces to those threats which they will encounter during an expeditionary operation. In addition, the ability of the United States to transport these weapons and their accompanying personnel into the area of operations within the first thirty days of the beginning of an expeditionary operation will be closely examined. This study of transportation will only include those assets which are currently in the United States inventory and which are capable of being able to load, transport, and unload their cargo by D+30. The transportation assets examined were those of the United States Air Force Air Mobility Command, which is comprised of transport aircraft, including the C-130, C-141, C-5, and the newly fielded C-17. Although the C-17 has just been recently fielded, only the numbers of aircraft currently available for worldwide assignment as of 1 December 1996 were included in this research. Concerning the additional C-17's which will eventually become available in the future, this thesis only examined current capabilities, and not those proposed for future completion.

The comparative approach was also used to examine the number of vital assets which have been assigned to U.S. forces during past operations and what the U.S. forces can be expected to protect during the first thirty days of operations in areas, such as Korea and the Middle East. These requirements were then balanced against the number of air defense assets which can reasonably be transported and established into an area of operations during the first thirty days of an expeditionary operation. The outcome of this portion of the research was then used to determine the ability of the United States to fulfill those military and geopolitical assets which will be proposed for coverage by ground-based air defense assets in future conflicts in which the United States will be involved.

Conclusion

This chapter provided the basis for how the research on this thesis was conducted. The types of methodology, the comparative approach, and the two case studies which were chosen to examine the material uncovered during the conduct of the research were discussed.

¹U.S. Marine Corps, *Up The Slot: Marines in the Central Solomons* (Washington: Marine Corps Historical Center, 1993), 9.

CHAPTER FOUR

ANALYSIS

This chapter used a combination of research methods to provide the data needed in determining an accurate outcome to answer the question of the thesis. The research examined two case studies of previous expeditionary operations, and an analysis of information on the current capabilities and limitations of the United States armed forces to handle the current threat found in the world was conducted. The two case studies are those of the Solomon Islands Campaign in 1942-1943 and Operations Desert Shield and Desert Storm which occurred during 1990-1991.

The Solomon Islands Campaign of 1942-1943 was chosen for study due to the continuous air threat under which these expeditionary operations were conducted. This campaign was conducted almost exclusively from start to finish without the benefit of air superiority, something that cannot be said of most expeditionary operations in the post-World War-II era. In addition, the operations conducted on the Solomon Islands which were studied are spread among three distinct landings during the course of this campaign. Each of these three landings show an understanding of mistakes that were noticed and rectified during previous landings, something that cannot always be said of present day operations.

Operations Desert Shield and Storm were studied for the impact they have had on present day operations of the United States armed forces. These two operations will reflect the advent of coalition warfare, rapid deployment, new weapons, and an expectation of low friendly casualties by the people of the United States. The response of the United States and the rapid

commitment of troops to the Persian Gulf will be closely examined to determine what the future responses will be to potential conflicts and the frequency with which these conflicts will occur. The ability of the United States to transport these troops and equipment to the region in a timely manner will also be examined to determine whether this was a capability or liability in terms of speed of force projection. The air and missile threats that the United States and coalition forces faced will be examined, as well as those assets determined to be of high enough value which were designated for protection by ground-based air defense systems. The decisions which led to the determination of targets designated as high value targets will be evaluated to establish if a distinct process was used in these decisions or not. Last, the ability of the United States ground-based air defense systems to protect the expeditionary force from air and missile attacks during the course of Operation Desert Storm will be examined.

The two case studies may appear at first to be very dissimilar, since they occur almost fifty years apart, are set in different theaters of war, and have two different enemies. In addition, the types of weaponry are so distinct that similarities of the capabilities and limitations are far from being close to one another; however, many similarities exist, and that is why these two case studies were chosen. The interwar period from 1919 to 1941 had many of the same problems facing the military that directly relate to the period directly before the Gulf War in 1990 and 1991. The military in both time periods had endured drawdowns, and the services were fighting among themselves for their share of the defense budget. The political infighting was in actuality no different in 1920 than it was in 1990, and the similarities do not end there. During the interwar period and also during the period before the Gulf War there is an emergence of personalities that are trying to influence the military that airpower is so massive and destructive to the enemy, that it is professed that the need for ground troops is outdated. The interwar period had General Billy Mitchell, and the period leading up to the Gulf War had Colonel John A.

Warden III, who professed the same philosophy with the plan he devised to win the Gulf War. *Immediate Thunder*.¹ The expeditions that occur on Guadalcanal and in the central Solomons during 1942-1943, and into Saudi Arabia during 1990-1991 also show the personalities of their commanders and their attitudes which directly influenced the use of ground-based air defense. During the early days of the battle for Guadalcanal, Admiral Fletcher decided that the United States Navy needed to depart the area due to the significant air threat which could have been directed against the carrier task force, its amphibious group, and transports which were supposed to support the landings.² This left the Marines without significant aircraft to defend the island, and this responsibility fell largely on the ground-based air defense units. In Operation Desert Storm, the United States Air Force was unable to locate and destroy a single mobile scud launcher, and the responsibility for the defense against this weapon fell upon the ground-based air defense units, this time in the form of United States Army Patriot missile batteries.³ These two case studies also see the use of joint and combined operations, which added to the abilities of the fighting forces, but also added to the coordination problems, which will be discussed later in the chapter. These two case studies were used to research the capabilities and limitations of ground-based air defense in joint expeditionary operations, and the outcome of this research is discussed near the end of this chapter.

Case Study Number One
The Solomon Islands Campaign of 1942-1943

Background

The United States was attacked from the air on 7 December 1941 by the Japanese First Air Fleet after launching from six carriers, being escorted by battleships, heavy cruisers, and submarines in the waters north of Hawaii.⁴ The United States armed forces which were stationed in Hawaii at this time were caught by surprise, both strategically and tactically.⁵ The 360

Japanese aircraft under the command of Admiral Nagumo inflicted heavy casualties on the United States forces stationed in Hawaii.⁶ Four of the eight U.S. battleships were either sunk or capsized, and the others were extensively damaged.⁷ Three light cruisers and three destroyers were also sunk or damaged, thus effectively neutralizing the United States Pacific Fleet.⁸ In addition to the more than 4,000 officers and men who were killed or wounded, more than 260 of the United States aircraft stationed in Hawaii were destroyed.⁹ Within the next forty-eight hours, the United States would see a majority of its other holdings in the Pacific attacked, to include the Phillippines and Wake Island, with their capitulations almost immediately assured. The next day 8 December 1941 with the confirmation of the Congress, the United States declared war upon Japan. Later that same day, Germany and Italy, members of the Axis Alliance with Japan, also declared war upon the United States. The United States was now in a two-front global war within twenty four hours after suffering a crippling and humiliating defeat at the hands of Japan. A decision as to what should be done next was to be made in conjunction with the United State's Allies of Great Britain, France, and Russia. The decision which was made was often referred to as *Germany First*, with a holding or delaying action being conducted in the Pacific Theater.

The war in the Pacific would initially start as that of a holding action, but would quickly transition to that of an offensive nature, with the first offensive ground action taken by United States ground forces during the war during the invasion of the island of Guadalcanal on 7 August 1942.¹⁰ The invasion of Guadalcanal within the Solomon Island chain initiated the start of Operation Watchtower, the code name assigned by the Joint Chiefs of Staff for the retaking of the Solomon Islands as a prelude to the destruction and capture the Japanese stronghold at Rabaul.¹¹

The invasion of the Solomon Islands or for that matter, the war against the Japanese should not have come as a complete surprise, for the United States had practiced it in over 127

war games at the Naval war College alone during the 1920s and 1930s.¹² The islands of the Pacific Rim had been seen as the sight of America's next war by numerous visionaries, which included a little known Marine Corps major by the name of Pete Ellis. Major Ellis had resigned from the Marine Corps before departing the United States for a clandestine operation to the Western Pacific in 1921 as a buyer for the Hughes shipping Company.¹³ Major Ellis's spy mission confirmed his earlier works which included a 30,000 word document that had become the outline for OPLAN 712 and was later used as the basis for the ORANGE PLAN and Rainbow 5, the plans which the United States would fight during the war in the Pacific.¹⁴

The invasion of the Solomon Islands was just part of this elaborate plan, thus it allowed the United States to seize forward bases from which it could operate and replenish its naval and air forces in its drive across the Pacific towards Japan. This concept was not lost on the Japanese, for they also had captured forward bases across the Pacific for these exact same reasons and were now within striking distance of Australia. The Japanese forces on Rabual and those on New Guinea would have to be stopped, before they invaded Australia or moved farther east: this was the purpose of Operation Watchtower.

United States Combat Forces and Equipment

The invasion of the Solomon Islands would require an amphibious landing, as would almost all of the operations which would be conducted in the Pacific theater of operations during World War II. The task of conducting amphibious operations had been refined by the United States Marine Corps during the interwar years in conjunction with the United States Navy's concept of operating from forward naval bases.¹⁵ The Marine Corps had seen this concept as a niche which was not filled by any of the other services and experimented with different pieces of equipment and new tables of organization to be able to conduct this type of operation.¹⁶ The formation of the Fleet Marine Forces in 1933 was predicated on this concept of seizing forward

naval bases and assisting with retaining these bases would be the newly created Marine Defense Battalions.¹⁷

The Marine Defense Battalions, a truly combined arms team, usually consisted of a headquarters and service battery, tank platoon, special weapons group (machine guns), 155-millimeter artillery group and a 90-millimeter antiaircraft group.¹⁸ The special weapons group routinely consisted of 30 caliber, 50 caliber, and 40-millimeter machine guns, the latter used for air defense.¹⁹ These ground-based air defense units within the defense battalions used their various calibers of antiaircraft guns, in combination with a new technology which had just began to emerge on the battlefield at that time, radar.

The antiaircraft group usually consisted of four firing batteries of 90-millimeter guns, with each battery having six guns assigned to it, with a table of organization reflecting nine hundred and seventy two officers and men.²⁰ The 90-millimeter M-1 antiaircraft gun was the staple of the Marine Corps air defense group, as it was capable of firing to a height of 38,500 feet. With a sustained rate of fire of twenty-two five-pound rounds per minute, the 90-millimeter antiaircraft gun was a formidable weapon for this time in history. Normally the gun had a crew of eight to twelve assigned to it at any one time. In addition to the 90-millimeter guns, the four batteries also had organic to them the SCR-270 radar and SCR-268 radars for early warning and firing control. The SCR-270 had the ability to detect incoming aircraft out to 150 miles.²¹ The SCR-268 could determine direction, height, and range all at once and was used also for fire control and initial gun laying. These radars, although considered primitive by modern day standards, were the most up-to-date radars that were technologically available and when employed properly with sufficient spare parts, were quite effective.

The special weapons' group also could bring a number of machine guns to the air defense fight, which included the 40-millimeter antiaircraft gun, which had a sustained rate of

fire of ninety rounds per minute.²² The 40-millimeter antiaircraft gun could also fire up to an altitude of 23,600 feet.²³

The .50-caliber M-2 machine gun was also used in the air defense role within the line regiments and in the defense battalions. The M-2 had a sustained rate of fire of up to 500 rounds per minute and could also fire up to 22,000 feet in height when employed in the air defense role.²⁴

The United States armed forces also brought a number of various aircraft which could be used for air defense purposes in the Solomon Islands during 1942 and 1943. The first fighter aircraft to see action in the Solomons campaign were those of the United States Navy and Marine Corps which were embarked on Navy carriers in support of the invasion bombardment preparations. The F4F Wildcat was the mainstay of the Navy carrier-based fighter aircraft and was also used by the United States Marine Corps. This aircraft had a top speed of 320 miles per hour and a ceiling capability of 19,400 feet.²⁵ The aircraft also carried four .50-caliber machine guns and could also be fitted to carry ordnance.²⁶ The major problem that the Wildcat had was the fact that it could not outclimb or outturn the Japanese zero. The United States Army Air Corps also brought a number of aircraft to the Solomons campaign to be used in the integrated air defenses. These aircraft included the P-400, which was actually the P-39 Air Cobra, a unique fighter for this time in aviation history. The P-39 was a midengine design, something that was quite a novelty, for the majority of the fighter and pursuit aircraft were all front-engine aircraft. This aircraft was severely underpowered, and this caused the aircraft to perform terribly in the fighter role.²⁷ In addition, lacking oxygen capabilities for the pilot, this aircraft was limited to only a 15,000-foot ceiling.²⁸ Thus, this aircraft would be mostly used in the ground attack role, but the fact remained that it was a fighter and was used during the early days of the campaign in this role, until such time that newer and more versatile aircraft could be brought into the area.²⁹

The reason that a older version fighter was brought into the area of operations is that it was expendable, much like the Marines who had been left on Guadalcanal when the Navy task force departed on 9 August, only two days after landing the initial Marines onto Guadalcanal.³⁰ The fact remains that the forces on Guadalcanal needed B-17 support to hit the Japanese in counterattacks, in addition to the support that the fighters gave in terms of local air defense and limited strike capabilities.³¹ However, the Air Corps had determined that the situation on Guadalcanal was too tenuous during the first thirty days on the island and thus deemed it too risky to send the bombers to Guadalcanal, for fear of losing them to a combination of Japanese ground, air attack, and naval gunfire from the *Tokyo Express*.³² Thus, the Army Air Corps had decided to send in additional fighter support in the form of the P-40 Warhawk. The P-40 was a capable fighter, but was becoming quickly outdated by the time it was employed on Guadalcanal during the fall of 1942. The P-40 had a top speed of 335 miles per hour., and a good climb rate when compared to the P-400, with a ceiling capability to 19,000 feet.³³ Although these aircraft were not the best that America could offer, at this time on Guadalcanal, with the situation as desperate as it was, any aircraft that could assist in stopping the Japanese air attacks was welcomed to the fight. The aircraft listed above were not the only ones to see action in the skies above Guadalcanal and the push into the central Solomons, but they were the only combat fighter aircraft used in the early air defense role during this period.

United States Transportation Assets

In addition to the significant industrial capabilities of the United States which allowed for the rapid and complex buildup of equipment and combat supplies, the other key capability was to be able to transport these combat forces into theater. The United States had significant numbers of both sealift and airlift assets to move combat power into the Pacific theater of war. The sealift that the United States possessed was found in both the civilian and military sector,

whereas the military aviation community would primarily provide the airlift capability during this time. Both of these capabilities and their impacts will be examined in the following paragraphs.

The majority of combat troops and equipment that would find its way into the Pacific theater of operations would be delivered by sea, and the reasons for this are readily apparent. The ships could carry larger and heavier equipment, but it would take longer to get into the AO than if transported by airlift.

The mainstay of the Navy transport shipping was the landing ship tank (LST). The LST was designed for the transport of troops and materials directly onto the shore of an enemy-held beach. This ability of this flat bottomed ship to beach itself would be extremely important for quickly landing combat loaded heavy equipment in an expeditionary operation. At 390 feet long and weighing in at only 1,653 tons, this ship was relatively small in feet and tonnage in comparison to the other Navy ships of this time. However, the role that it would play in the transporting of this equipment would be unsurpassed in importance to the landing forces.³⁴ The United States planners were able to count on the ability of these 1,052 ships to get a number of troops and equipment into the amphibious operation area within the first thirty days of an operation, and most often as not, starting within the first hours of the actual landing.³⁵ This capability is important, in that the Japanese did not have the number and quantity of ships of this type that the United States did, and this capability was extensively exploited throughout the course of the war, in both of the theaters.

In addition to the shipping assets, which could bring large numbers of heavy equipment and supplies into an area of operations, one of the most important transport capabilities was that of the Douglas R4D Skytrain. This aircraft was used in every suboperation of Operation Watchtower for quick resupply of the combatants after landing on the islands. The R4D was

originally designed in 1933 as the standard transport aircraft of the armed services. The R4D was the designation given to this aircraft by the Marine Corps, it was also known as the Dakota in the U.S. Army, the C-47, and more commonly as the DC-3 in the civilian configuration. The R4D was powered by two Pratt and Whitney radial engines which produced 1,200 horsepower each.³⁶ Capable of carrying 28 passengers or 18 stretchers, and 3 medical attendants, it could also carry up to 7,500 pounds of cargo at speeds up to 229 miles an hour.³⁷ The U.S. forces used the Skytrain throughout the Solomon Islands Campaign, and in every possible mode, from resupply, to aerial delivery, to airborne assault.³⁸

United States Military Strategy

The United States had begun to develop as early as 1914 a plan with which to fight the Japanese in the Pacific.³⁹ This plan was put on hold during World War I, but the ideas again resurfaced when a 30,000 word document was published by Major Earl H Ellis, United States Marine Corp in 1921. This document was accepted by the Commandant of the Marine Corps as the plan which the Marine Corps would use to promulgate training of the Marine Corps in amphibious doctrine, and it served as the basis for the Orange Plan, and later for Rainbow Five, the plans with which the United States would fight World War II.⁴⁰ These plans called for the movement west from the Hawaiian Islands through the north central portion of the Pacific directly towards Japan. In addition to this forethought, was the fact that this plan would go into detail on the amounts of combat forces which would be needed to successfully attack the Marshall and Carolina Islands. One of the flaws that could be found within this document was that although it was extremely well thought out, it did not take into account the fact that some of the islands could be bypassed, thus limiting the number of combat losses in unneeded campaigns. The last thing that was overlooked in this document was the amount of infighting which would take place amongst the services, nor the influence of General Douglas MacArthur, USA. At the

start of World War II, Douglas MacArthur was the marshall of the United States Territory in the Philippine Islands. A retired brigadier general, he was called back to active duty on 26 July 1941 with the rank of major general, and was subsequently promoted to lieutenant general the next day with a date of rank of 16 September 1936.⁴¹ This is important in the context of this thesis, in that the influence that General MacArthur later wielded as the Supreme Allied Commander in the Pacific, which would be unthought of today, had a direct influence on how the war in this region would be fought. After escaping from the Philippine Islands by P.T. boat in early 1943, General MacArthur would establish his headquarters in Brisbane, Australia, then New Guinea, and later move it throughout the Pacific. However, when MacArthur left the Philippines in the early, dark days of 1943, he had made a pledge to the Philippine people that one day "I shall return," and this pledge would arguably change the course of World War II. The three words which made up this many time repeated pledge would be a matter of controversy to this day. Why this pledge was made has been the matter of intense scrutiny over the last fifty years by a number of scholars and received new interest in 1979 when it was discovered for the first time that MacArthur had received a personal *gift* from the President of the Philippines in 1943 of \$500,000.00 U.S., so as not to forget the Philippines in his march across the Pacific towards Japan.⁴² This personal pledge to the people of the Philippines and whatever other influences that were behind his decision to regain the Philippines would make a two-prong attack towards Japan the matter of course, vice the one combined attack as foresaw in the Orange and Rainbow Plans developed and refined over the past thirty years. As the concepts to retake the Pacific were refined, the Trident Conference was called in Washington in May, 1943 and after much heated debate, the two-prong attack plan was adopted and approved by the Combined Joint Chiefs on 8 May, 1943.⁴³ The stage was now set for a two-prong attack towards the Japanese homelands, and with this two-pronged attack came the realization that the much-needed air support from the Navy carriers

would be limited in each of the attacks across the Pacific.⁴⁴ The need now for establishing ground-based air defense units ashore shortly after landing the assault forces would be critical, as would be seen during the battles conducted during the Solomon Islands campaign.

United States High Value Targets and their coverage by Ground-Based Air Defense

The United States' drive across the Pacific would depend upon establishing forward naval and air bases across the Pacific to support the drive towards the Japanese homelands. Once the first combat troops were landed, the next priority would be protecting the gains made by the ground forces in this lodgement from counterattack. The protection of this lodgement area would initially fall on the abilities of the ground-based air defense units and carrier based squadrons when they were in the amphibious operations area. After establishing a tentatively secure lodgement area and once the airfield was prepared to receive aircraft, air support was brought ashore. But, during the critical time from the start of the operation, until such time that the squadrons were brought ashore, the lodgement area was extremely vulnerable to attack from Japanese aircraft. The Navy carriers, extremely valuable, for they were usually the only source of providing fighter support, were in high demand and short in supply. Needed in both the southern and central regions, split by personalities and differences in philosophy, air support from the carriers diminished quickly after the initial landings occurred. Thus, during the Solomon Islands Campaign we will see a ever decreasing number of ground-based air defense units attempting to cover an ever-increasing number of assets deemed of high value by the commanders. This problem of covering numerous high-value targets will play heavily on the commanders during this campaign and will not be solved, in that there will be assets which will remain inadequately covered by ground-based air defense assets, and will be destroyed because of this factor.

During the first thirty days during the battles for Guadalcanal and the other Solomon Islands, will see the commanders attempt to cover four principal areas with ground-based air defense. The four principal areas that received priority of coverage by ground-based air defense assets were the: lodgement areas and beachhead, command and control centers, supply dumps, and the airfields after being secured.⁴⁵ Due to the fact that there were no existing major populace or cities on the islands that were invaded during this campaign, geopolitical considerations did not have an influence on where the ground-based air defense assets were distributed. It should be noted that the landing forces, whether Army or Marine Corps, usually colocated the command and control centers at or near the airfields, as was the case on Guadalcanal, creating less of a problem for the air defense gunners than might have been the case. During the lodgement phase of the operation, the immediate landing area was the first priority for air defense, logically, because that tended to be the only ground that the United States forces had possession of at that point.

The first ground-based air defense that is seen coming ashore during the Solomon Islands campaign tended to be the .50-caliber, M-2 machine gun which typically landed with the assault forces. Although this weapon was usually assigned to the combat regiments and to the special weapons platoon of the defense battalions and was used in the ground defense mode, it was also the first weapon in the lodgement area capable of engaging enemy aircraft. The next weapon that typically made its way into the lodgement area was that of the 20-millimeter or 40-millimeter antiaircraft gun. These weapons, because of their relatively small size in comparison to the 90-millimeter antiaircraft gun were the logical choice to get into the lodgement area. Weighing in at only 5,418 pounds, they were easier to move across a undeveloped beach than was their sister gun the 90-millimeter.⁴⁶ The 90-millimeter weighed almost 19,000 pounds, and because of its large size, it was usually not brought into the lodgement until the area was built up enough to

sustain it across the beach or at least until the bulldozers could be brought ashore to drag it onto more compacted ground.⁴⁷ However, it should be noted that when the terrain was favorable, the 90-millimeter was brought into the lodgement area early to take advantage of its superior range and punch, as was the case on Kokorana when the entire Antiaircraft Group was ashore and prepared to fire by 1645 hours on D-Day, 30 June, 1943.⁴⁸

United States Command and Control

The United States had a vast number of ground-based air defense units in the Solomon Islands Campaign, from the defense battalions of the United States Marine Corps to the air defense units of the United States Army. The task of how to place a unified command and control system over them was impossible. Thus, the task of coordinating command and control over these various units was delegated to the small unit commanders of the ground-based air defense units themselves.

Early warning on the other hand was usually a coordinated effort. The coast watchers had been placed on the islands of the Solomons with the help of the Australians and provided an extremely capable early warning asset.⁴⁹ It was normal that the ground-based air defense units on Guadalcanal would receive inbound aircraft alerts up to three hours in advance of the enemy overflying the island.⁵⁰ In conjunction with the radar systems established and operated by the defense battalions, this system usually worked out to be more than adequate. In addition, this information was usually passed from the coast watchers to the higher headquarters and then down through the chain of command, thus the pilots, if established ashore by this point, also received the warning. This allowed the pilots to time their takeoffs so that they would neither be caught on the ground nor be low on gas from taking off too early. Although this was not always the case and there were times that the early warning did not work as planned, it was as effective system as could reasonably be expected given the capabilities of the day. During the landing of

the Marine assault forces onto Guadalcanal during the early hours of 7 August 1942, the Navy retained control of the airspace over the amphibious operations area from the ships just off the shore, and this capability was retained by the Navy until the Marine Corps could buildup enough airpower ashore to protect themselves.⁵¹ This buildup of fighters was not accomplished until 20 August when VMF-223 flew on the newly secured mud airstrip, commissioned Henderson Field, in honor of a Marine fighter pilot who was killed during the battle for Midway.⁵² The VMF-223 flew the Grumman F4F-3 Wildcat, a slightly obsolescent airplane which had been originally designed as a fixed-gear biplane and which was hastily converted after its acceptance by the United States Navy into a midwing monoplane outfitted with retractable landing gear. Now that the airfield had fixed-wing fighter support, and the ground-based air defense units, coordination was needed to allow for the maximum use of both and to keep the potential for fratricide at a minimum. This coordination was done by the headquarters of VMF-223, and a forward detachment from the 1st Marine Air Wing.⁵³ The command and control center was placed inside the pagoda, as this was the only covered building that was still standing near the runway, with the exception of some dilapidated hangars which housed the maintenance bays for the aircraft.⁵⁴ Although an extremely rudimentary command and control center was established, it was relatively efficient, in that it interpreted and passed early warning to the pilots and air defense units when it was received from the coast watchers. In addition, this command and control system also allowed for the passing of information on returning pilots to the ground-based air defense units to negate the possibilities of fratricide. The only radars that existed on the island during this time were those assigned to the Marine Defense battalions, and their tracking of the targets would be also passed up the chain of command to the 1st Marine Wing headquarters, who would then pass it onto the pilots for final vectoring of the sorties to intercept the incoming Japanese bombers and fighters.⁵⁵ This system, although extremely primitive, was the basis for

command and control that would be used during the entire central Solomons campaign. The influx of United States Army Air Corps P-400 and P-40 fighters and B-17 bombers during the latter days of August and early September did not prohibit the command and control system from the procedures established earlier, and the addition of Army Air Corps personnel in the form of liaison and watch officers simplified their arrival and early operations on the island.

Japanese Combat Forces and Equipment

The Japanese combat forces in the region consisted mainly of naval forces, since the Japanese Army had the responsibility for the war in China and Burma. The Japanese Navy had established forward bases throughout the Pacific, much as the United States was now having to do, in order to strike across the Pacific to attack and invade mainland Japan. The Japanese had always had a strong navy, which was comparable to that of the United States'. This strong Japanese navy was even more a threat, now that the United States was conducting offensive operations so far from the North American continent.

The Japanese combat forces had been conducting combat operations against China since the invasion of Manchuria in 1931 and were a battle tested and hardened foe. In addition, with the battles of the Coral Sea and Midway a part of history, the Japanese forces now realized that the Americans were in this until the end and were not amenable to an early peace accord as the Japanese leadership had hoped after the surprise attack on Pearl Harbor almost a year before the American invasion of the Solomon Islands. The Japanese on the Solomon Islands chain knew that the Bushido Code would mean defense to the death was to be expected on the islands protecting the Japanese homelands. This fight to the death attitude was prevalent when the Japanese high command had stated that if Guadalcanal and the Solomon Islands were lost it would mean that the war was lost. The Japanese were prepared and equipped for a battle of the likes of which the United States had not seen since leaving the battlefields of France in 1918.

The Japanese ground forces, who were extremely well trained and equipped, were extensively used throughout this campaign, both during the defense of the islands which made up the Solomon Islands chain and in the attempts to reinforce and attack the United States forces when landing in and defending the lodgement areas. However, for the scope of this thesis, the concentration will be on the air and naval forces which directly influenced the transportation to, landings and defense of the lodgement areas against the ground-based air defense units.

The Japanese Air Forces were equipped with a mixture of fighters, torpedo and dive-bombers, and the heavy and medium bombers with which they conducted long-range air attacks upon the lodgement areas on Guadalcanal and throughout the Solomon Islands chain. The mainstay of the fighter corps was the highly regarded *Zero*, which for this time was the most maneuverable fighter in the Pacific theater. With the Mitsubishi A6M, which had a top speed of 332-miles per hour, and a ceiling limitation up to thirty 32,810 feet, the Japanese had a top-notch fighter, and one which the United States pilots could not climb with, or out turn.⁵⁶ The *Zero* had two 7.7-millimeter machine guns and two 20-millimeter cannons, and could also carry 264 pounds of ordnance if so equipped.⁵⁷ However, the Japanese *Zero* had a couple of significant flaws, to obtain its fast speed, armor for the pilot and self-sealing gas tanks were sacrificed.⁵⁸ This meant that, if the *Zero* could be successfully hit by aircraft in dogfights, or by the ground-based air defense units, it had tendency to catch on fire and more often than not, explode.⁵⁹ The two main threats to the lodgement forces on the ground, however, came from the dive-bombers and the medium and heavy bombers, and their armor had not been sacrificed in the desire for more speed and maneuverability. The twin engine *Betty* bombers were the mainstay of the Japanese air force's offensive bombing capability. The *Betty* had a top speed of 272 miles per hour, and more importantly the ability to drop its 2,205 pounds of ordnance from its ceiling height of 29,365 feet, at the outmost reach of the ground-based air defense units

capabilities.⁶⁰ The bombers were the key to delivering the firepower necessary upon the American forces from the air; however, the Japanese also had another offensive capability which affected the ground forces in the lodgement areas, that from the guns of the destroyers and cruisers which were providing naval gunfire support. The Japanese cruisers and destroyers which escorted the transport ships full of supplies and troops sent to reinforce the beleaguered garrisons were dubbed the *Tokyo Express* and played a significant role during the early days of this operation, for their presence, in addition to the air threat, made the United States Navy pull out from the lodgement area early. In addition, these destroyers and cruisers, which had the ability to shell the airfields and ground combat emplacements, contributed to the fact that the United States Army Air Corps would not place the B-17 bombers on Guadalcanal for fear that they would be lost. The combination of these Japanese forces, their equipment, training, and combat experience made them a formidable foe for the American forces which would face them in the Solomon Islands chain in late 1942 and 1943.

Japanese Transportation Assets

The Japanese had numerous types of sea-lift capabilities and also a sufficient number of them at this point in the war. However, their ability to transport troops and equipment by air were limited, usually relying on the *Betty* bomber to transport the troops and supplies into needy areas. Thus, the sea-lift capability of the Japanese was the mainstay of the resupply and reinforcement for their garrisons on the islands of the south Pacific, and none in more need than those of the farthest islands from the Japanese homelands in the Solomons. The Japanese were able to transport approximately four thousand troops, their equipment and supplies into the fight for the Solomons.⁶¹ However, this capability to transport supplies and equipment was offset by the ability of the United States to intercept a vast number of these shipments from the sky by the efforts of the airmen and sailors of the United States.

Japanese Military Strategy

The Japanese strategy had relied on the United States being decimated by the surprise attack at Pearl Harbor and opting for a early peace with Japan, so that it could concentrate on its war with Germany on the European continent. However, the surprise attack on Pearl Harbor had not caught the United States Navy's carriers in port. With the United States' industrial capabilities, the Navy resurrected the ships which were sunk during the attack on Pearl Harbor, and the nation's will was to carry the fight to the Japanese homelands. This was not what the senior leadership in Tokyo had foreseen, with the exception of Admiral Yamamoto, who had been educated at Yale University and had seen the industrial might of the United States.⁶² With the United States now in the fight for the Pacific, the Japanese stopped their expansion in the East after the spring of 1942 and beset itself on the defense, with follow-on offensive operations now put on hold. The Japanese Empire would now plan for a defensive fight, using the outer ring of island chains, such as those of the Solomons, Gilberts, and Marshalls as the front lines of the homelands defense. The defense and survivability of the Japanese homeland would depend on the ability of the Japanese to defend on lands which were expendable and which they had no emotional ties to. This defense of the outer islands would be fierce, and without mercy for those attempting to gain a foothold into them. Because the Japanese did not want American troops on their native homelands, and they would give their lives in the attempt to make sure that this did not happen. The Solomon Islands Campaign was assured to be met with a stiff resistance and a fight to the death for those defending this chain of islands, a death under the provisions as set forth in the Bushido Code. Thus, every man that was available would be sent to reinforce the invasion of the Solomons, and this included those forces of the Japanese Army, which for the most part had been limited to fighting in the China and Burma theaters. General Hyakutake of the Japanese high command stated in late August of 1942, "... the operation to surround and

recapture Guadalcanal will truly decide the fate of control of the entire Pacific area. . .” and thus the Japanese Empire would cease to exist. Therefore, the Japanese could not allow the Americans to retain Guadalcanal.⁶³

Japanese High-Value Targets and Their Coverage by Ground-based Air Defense

The Japanese on the Solomon Islands realized that their defense relied upon their ability to retain and defend the airstrips from which their fighters and bombers would be flown and thus proceeded to place them as the number one priority for the ground-based air defense units that accompanied their expeditionary troops into the Solomon Islands chain. The Japanese, much like the Americans placed an extreme importance on their air forces and thus protected them at all costs, and again like the Americans, they also placed their command and control for these air forces in the facilities near the airfields. The Japanese would then have a number of high value targets in and around one general area, allowing for a well-protected area from which to facilitate their command and control. This integrated air defense, consisting of fighter cover and ground-based air defenses would be concentrated and extremely formidable. In these terms, the Japanese and Americans were very much the same; it was in the execution of these defenses that a difference would be seen.

Japanese Command and Control

Japanese Command and Control was established to perform basically the same functions as those of the United States, and the systems were similar with two major exceptions. These two exceptions were the coast watchers and the use of radar. The Japanese did have numerous garrisons on the islands of the South Pacific, but these garrisons were found and plotted on the maps which American Air Corps and Navy planners used to establish routes for air attacks, and when possible, the routes would simply bypass these known installations, negating the possibility

for long-range early warning on the part of the Japanese. In addition to this was the small number of Japanese radar units which could forewarn of impending American air attacks. Thus the Japanese did not have the luxury of early warning to the extent that the Americans did, which proved to be another one of the downfalls of this campaign on the part of the Japanese. This apparent lack of early warning, when coupled with poor intelligence on the part of the Japanese rendered their command and control capabilities almost ineffective.

The Battle for the Solomon Islands

The battle for the Solomon Islands began in earnest with the landing of United States Marines on the Island of Guadalcanal on 7 August 1942 and constructively ended with the use of recently secured Munda Airfield on New Georgia by Commander Aircraft Solomons on 20 October 1943.⁶⁴ This thesis will cover the ground scheme of maneuver in broad terms in order to present an understanding of the concept of the tactical operations as they relate to the battle for the islands, however, it will focus on the concentrations of ground-based air defense units and on how they contributed or detracted from the efforts to secure the lodgement areas.

The preparations of aerial and naval gunfire took place to destroy and neutralize as much of the Japanese defenses on the island of Guadalcanal as possible in the short time allowed for this portion of the operation. However, as the preparation fires had been concentrated along the coastline, and the Japanese concentrated the majority of their defenses inland, the results were negligible. The initial assault forces, which consisted of the 5th and 1st Marine Regiments coming ashore on Guadalcanal, met little initial resistance, and rapidly secured a tentative lodgement area along their initial objective on *Red Beach* by 0940 hours.⁶⁵ The lodgement area consisted of an area approximately 1,600 yards long and 600 yards deep.⁶⁶ Closely behind these forces were the reinforcements, which began to come ashore by 1100 hours.⁶⁷ These reinforcements consisted of Marines from different units, which included the initial ground-

based air defense elements of the 3rd defense Battalion.⁶⁸ These elements of the 3rd Defense Battalion were the only ground-based air defense assets that the 1st Marine Division had and would turn out to be the only dedicated air defense that the landing force would have until the arrival of the first fighters on the twentieth, some thirteen days later.⁶⁹ For this period, the Japanese controlled both the air and the sea.⁷⁰ It was during this period that the 3rd Defense Battalion pulled their guns tightly around the airstrip, to protect against or at least make the bombers who made it through the fighters, release their bombs early, and hopefully away from the vital assets of this area.⁷¹ The Navy fighters of the task force were assigned to be in general support of the landings, but these assets would soon be returning out to sea with the departure of the task force. The initial landings actually went somewhat smoothly, with few casualties during the ground fight for the lodgement area, and the offloading started from the ships which closed to the shore. However, problems soon arose in that the offloading parties which did show up were inadequate for the task at hand, and the supplies and equipment which were desperately needed by the ground forces were actually flowing off of the ships faster than they could be sorted and moved forward from the beachhead.⁷² This quandary, posed a direct problem to the ground-based air defense units of the 3rd Defense Battalion, for some of their 90-millimeter guns were being held on the ships that were still unloaded and resting off the shore. The 90-millimeter guns that were brought ashore had to be towed to their defensive positions by bulldozers, for the 3rd Defense Battalions trucks were not yet on the beach due to the back up of supplies clogging the beachhead.

The offloading continued very slowly, and then stopped during the first of many Japanese air raids which began at 1320 hours. The target of the attack for the Japanese aircraft were the transports and naval ships which were unloading and supporting the initial landings.⁷³ The raid consisted of eighteen *Betty* bombers who dropped their ordnance from twenty thousand

feet, thus initially avoiding the fire sent up from the transports and initial ground-based air defense machine guns who could not reach them.⁷⁴ The bombs did not strike anything of value, and the working parties again slowly went about their business, as did the assault forces of the infantry regiments moving inland to expand the lodgement area.⁷⁵ The offloading of the supplies and equipment continued throughout most of the night, with Marines being sent back to the rear from the infantry regiments to help with the offloading. The next day brought a continuation of the same, until another two Japanese air attacks the next day, during which twenty two *Betty* bombers and ten *Val* dive-bombers attacked in separate raids, during which the combined efforts of the ships and ground-based air defense guns shot down three aircraft.⁷⁶

The combination of these air attacks, and the devastating defeat dealt to the United States Navy during the Battle of Savo Island on the night of 8-9 August, during which the Navy lost two destroyers, four cruisers led to the decision by Admiral Turner to withdraw his transport ships early to the safety of the open sea.⁷⁷ This hurried and unscheduled early departure meant that the 1st Marine Division ashore had less than three days of supplies for the 17,000 men that were ashore, and only eight hundred rounds of 90-millimeter ammunition.⁷⁸ In addition, although most of the divisions men were ashore, their equipment was not, for most of it was still onboard the Navy transports which had now departed. The 1st Marine Division had only the antiaircraft guns, with which to protect the entire invasion force, the newly captured airfield, and the lodgement area which still had supplies stacked up in it. This posed a dilemma for Lieutenant Colonel Pepper, the Commanding Officer of the 3rd Defense Battalion, for he did not have all of the assets and men that he had expected with which to defend the division. After conferring with General Vandegrift, the Commanding General of the 1st Marine Division, it was decided that the airfield had to be defended, along with the precious few remaining supplies, which were moved as close to the airfield as possible for ease of logistics, and ease of protection from attack.

However, the beachhead had to still remain defended, for incoming supply runs were expected to be attempted by the Navy, and the fact remained that the some supply dumps remained near the beach. The command post was established in the vicinity of the airfield, so that too would be covered with less waste of air defense assets to be spread over a wide area.⁷⁹ The infantry regiments would go virtually unprotected by ground-based air defense due to lack of the AAA guns, men and ammunition. The Navy would continue to provide nominal air coverage of the island from afar, but this proved to only be haphazard, for almost daily, the Japanese air attacks would still make it to the island to continue the unrelenting assaults that had begun on 7 August. The daily air attacks were then joined by almost continuous night attacks by the Japanese Navy, lobbing naval gunfire onto the beleaguered Marines on the airfield. The supplies of food had for all practical purposes run out, with most of the Marines subsisting on captured Japanese rice and other foodstuffs. The food could be for the most part procured, but spare parts for broken guns and ammunition for the 3rd Defense Battalion was running extremely low with the daily air attacks depleting the stocks quickly. Reinforcements and equipment began to arrive on 15 August, with the arrival of ground crews and equipment for the anticipated fighters, on 20 August, along with SBD dive-bombers, used against the Japanese positions on the island and against the Japanese Navy which was hampering further resupply of the Marines ashore. The arrival of the fighters and SDBs allowed a new flow of reinforcements and some supplies onto the island, but not enough to replenish the already dwindling stocks. However, the 3rd Defense Battalion did at the end of August receive their radars, and 5 inch coastal guns, which reinforced the island defenses.⁸⁰ With this arrival of radars and equipment, the 3rd Defense Battalion had three automatic weapons and two 90-millimeter antiaircraft batteries assigned to defend the airfield.⁸¹ A subsequent arrival of transports brought assets from the 5th Defense battalion ashore, and this freed a 90-millimeter battery of the 3rd Defense Battalion to be transferred

across the channel to Tulagi island for protection of those forces there, and also to assist in providing an air defense umbrella over the channel for incoming resupply ships. But the fact remained that the battalion could not provide a complete defense for all the assets which needed to be protected. In addition, although the SCR 270 worked well for early warning, the SCR 268 was not accurate enough for controlling the fires of the 90-millimeter gun batteries at night.⁸² To further complicate matters, only one of the three 90-millimeter gun batteries had been equipped with the remote control system by which the guns could automatically be trained by the gun-laying fire control directors.⁸³ The 90-millimeter guns of the other two batteries had to be trained by hand which proved to be much less accurate. The tribulations of the flying squadrons proved to be no less eventful, for they were down to only thirteen F4F's at the end of August, from the original nineteen.⁸⁴ This situation again left the battle for the island in a quandary, for the Japanese had landed reinforcements at night on different occasions during the battle for the island, and in addition, their daily noontime air raids and nightly shelling by the *Tokyo Express* continued. The battle continued in this manner for the first thirty-plus days of the campaign, until a major Japanese counteroffensive occurred on 12-14 September. This counteroffensive and another one in November showed the importance which Guadalcanal held for the Japanese High Command. The reinforcement of the Marines, and their subsequent replacement by troops of the 25th and 43rd Divisions of the United States Army who conducted mopping up operations until the island was announced secured on 9 February 1943 closed the chapter on this portion of the Solomon Islands campaign.⁸⁵ However, the fight for the Solomons had in all actuality just begun, and it would not end for another year.

The drive through the central Solomons consisted of the main landings on the islands of Rendova, New Georgia, and Vella Lavella. This drive took place over the period from 11 February to 25 September 1943. Although this period takes place over an eight month period,

only the first thirty days of each of the campaigns will be used in determining the impact that ground-based air defense had upon accomplishment of the operations.

The Russell Islands were quickly taken by elements the United States Army's 43rd Division on 11 February 1943, and subsequent preparations were made for the invasion of New Georgia, the site of the principal Japanese air base in the central Solomons. In addition, this air base was also the home base for General Noboru Sasaki, the commander of all Japanese air forces in the Solomon islands. But before the landings could be made on New Georgia, the island of Rendova would have to be taken. During the initial landings on Rendova and a supporting attack on Kokorana, elements of the 9th Defense Battalion ended up landing ahead of the assault waves, and luckily only met light resistance. By the end of the first day of the landing, E Battery of the antiaircraft group had set up on Kokorana and was prepared to fire by 1645 hours.⁸⁶ All of the light antiaircraft guns were landed and emplaced along the coast to protect the lodgement's beachhead by nightfall, but the remaining 90-millimeter batteries were not unloaded yet.⁸⁷ Heavy rains and bad weather made unloading the heavy guns near impossible over the beach, and many had to be dismantled, dragged along through the mud by bulldozers and amphibious tractors, and then reassembled at their firing points.⁸⁸ This made the unloading extremely difficult, and congested an already disarrayed lodgement area. The conditions on Rendova were no better, and the movement of the antiaircraft guns into the lodgement area was slow and methodical. Eventually all of the guns were emplaced, and the batteries were dug in positions and poised for the first Japanese air attack which broke through the American air cover on 2 July. A flight of 18 G4M Betty bombers and Zeke fighters attacked the island inflicting heavy casualties on the newly defended lodgement area.⁸⁹ Four Defense Battalion Marines were killed, one was MIA, and twenty two were wounded.⁹⁰ In addition, damage also included a loss of two of the 40-millimeter guns, and numerous artillery guns and amtracks destroyed. Although

the guns of the Defense Battalion fired at the attacking aircraft, none of the Japanese planes had been shot down. This was attributed to the fact that the SCR-270 radar had not yet been installed, and that a mistake had been made when the SCR-268 generator had been accidentally fueled up with diesel instead of gasoline, putting the radar out of the action during the air attack.⁹¹ This was not the most auspicious of beginnings for the ground-based air defense unit on Rendova.

Supported by artillery fires from the island of Rendova, and those of the naval task force, troops of the United States Army's 37th and 43rd Division landed near Munda Airfield on the southern portion of New Georgia Island on 2 July 1943.⁹² The main landing of these two Army divisions landings had been reinforced by earlier landings of Army and Marine regiments at various points to the northwest and southeast of Munda. These landings were conducted onto an island which had no roads, no major ports or developed facilities. The terrain was much as it had been at Guadalcanal, mountainous, jungle covered, pest ridden and extremely hot and wet. These islands were considered by John Miller, Jr., a former Marine, who later became a Army historian "... one of the worst possible places ..." to fight a war such as this one. Not only would the Japanese air, ground and naval attacks take a toll on the American forces, but the terrain and climate would also inflict heavy damage to both men and equipment.

Attached to the XIV Corps in support of the landings near Munda Point was 9th Defense Battalion commanded by Lieutenant Colonel William J. Scheyer.⁹³ The 9th Defense Battalion was organized to consist of a field artillery group, heavy antiaircraft group, and a light antiaircraft group. The heavy antiaircraft group consisted of four batteries of 90-millimeter guns (Batteries C, D, E, and F) with the light antiaircraft group consisting of two batteries of 40-millimeter guns, dual mounted 20-millimeter guns, .50-caliber and .30-caliber machine guns.⁹⁴ For this campaign the battalion consisted of 1,459 officers and men, some of which had spent

time on Guadalcanal, where at one time or another over forty percent of them had malaria. The prospect of contracting a disease was always prevalent, and would hinder all of the forces in the Solomons over time, but it would for some reason hit the 9th Defense Battalion particularly hard. During the course of the campaign on New Georgia, the battalion would end up losing an average of 2.24 men per day, or approximately 65.17 men per month.⁹⁵ These losses due to disease were important to note, for they would hamper the battalion's attempts to provide adequate air defense coverage for the lodgement areas and later the airfields. With the initial landings near Munda, and eventual drive towards the airfield on 30 June 1943, were elements of the 9th Defense Battalion. The first air attack in which the 9th Defense Battalion struck back was on 4 July when at 1430 16 Betty bombers and their fighter escorts broke through the allied fighter cover and proceeded to bomb the area.⁹⁶ Only 4 of the 16 bombers managed to get their bombs away, and in the subsequent firing by E Battery, and the machine guns of the Special Weapons Group, twelve bombers and one Zeke fighter were destroyed.⁹⁷ The E Battery had fired a total of eighty-eight rounds and destroyed 12 of 16 bombers for a 75 percentage shot down on this raid. Although only 4 of the bombers managed to get their ordnance away, it took a substantial toll, with 1 officer and 3 enlisted Marines killed, and a heavy machine gun and a 40-millimeter gun destroyed.⁹⁸ On the next day, another 90-millimeter battery and a light antiaircraft machine gun detachment from the 11th Defense Battalion arrived to reinforce the established defenses of the 9th Defense Battalion.⁹⁹ These additional assets were positioned on both Kokorana and Rendova, while a detachment consisting of twenty two men with one 40-millimeter gun, one twin 20-millimeter gun, and two .50-caliber machine guns was sent under a lieutenant to protect the United States Army infantry units at Laiana beach, only two miles from the Japanese held Munda field. This detachment would not only see attack from the air, but also substantial ground fighting during the push towards Munda field to the point that the Japanese

infantry were firing at the men manning the AA guns during the air attacks.¹⁰⁰ After substantial daylight losses, the Japanese turned to night time air attacks, which proved not to be beneficial for them, and they ended up losing a total of 26 aircraft to the fires of the ground-based air defense units on Rendova.¹⁰¹

The Munda Airfield was secured on 5 August, thus ending the first 30 days of this campaign. However, the 9th Defense Battalion would remain on the island for the next month and a half, during which time it proceeded to down 21 Japanese aircraft, until relieved by the United States Army's 77th AAA Group which would take on the duties of the occupation. The island of Vella Lavelle was secured on 7 October 1943, and with that last island came the end of the Guadalcanal and central Solomons campaign. During this campaign the Japanese lost approximately 900 aircraft to the joint efforts of the United States Army, Marine Corps, Navy and Army Air Corps

The total number of aircraft downed, nor the percentages are as significant as are the importance of the lessons which can be taken from this campaign, and how the United States military has applied them to present day.

Importance of the Solomon Islands Campaign

The main lesson that can be learned for ground-based air defense from this campaign is that once hostilities have begun, the enemy will conduct immediate air attacks against the expeditionary force upon and possibly before arrival in the area of operations, and that the expeditionary force must be prepared to counter this threat. The Japanese attacked the expeditionary forces on every one of the landings within the first 24-hours of arrival in the area of operations.

The second lesson is that a large amount of lift capabilities must be available to move these assets in to the theater of operations, but also, that although this transportation capability

may exist, it must be utilized effectively, as evidenced by the Japanese' loss of shipping and United States inability to unload from the transports in a efficient manner.

The third lesson is that a mix of ground-based air defense weapons be brought into the AO quickly. This was evidenced when the 1st Marine Division could not protect against the bomber attacks during the early battle for Guadalcanal because the 90-millimeter guns were not yet established, and the smaller guns could not reach high enough to hit the attacking bombers. A mix of ground-based air defense guns would have assisted to alleviate this problem. This can also be evidenced when the aircraft of the 1st Marine Air Wing, and the U.S. Army Air Corps could not operate from the islands airstrip for the first thirteen days of the operation, leaving the defense of the island to that of the ground-based air defense units.

The fourth lesson that can be taken away from this campaign is that a system of integrated air defenses are essential, for this thesis shows that during the time that Guadalcanal was unprotected by direct air coverage, and only that of ground-based air defense units, the number of successful enemy air attacks was higher than when both the ground-based air defense units and combat air patrols were used in conjunction. In addition to this integration of air and ground-base air defense systems, this thesis makes the point that a combination of AA guns were needed to compliment each others capabilities as was evidenced during the campaign on Rendova. Also seen was the need for early warning, and that of different types, which compliment the capabilities of the other. The coast watchers and the radars both had certain capabilities, and they also had certain limitations, but when used in conjunction with each other, they proved to be a viable system.

Lastly, this case study showed the need for prioritization of those assets which needed to be protected, as was evidenced on Guadalcanal when the Gen. Vandegrift ordered the 9th defense Battalion under Lt.Col. Pepper to cover only the vital assets, and that the infantry

regiments had to be uncovered to ensure the proper protection of those areas deemed high value targets by the commanding general. This type of command decision is not an easy one to make, and this dilemma will once again be seen, as will some of the points this campaign made during the second case study, Operation Desert Shield/Desert Storm.

Case Study Number Two Operation Desert Shield and Desert Storm

Background

On 2 August 1990, the country of Kuwait was invaded by Iraq, and within three hours, the country was claimed secured by Saddam Hussein's forces.¹⁰² This invasion, which had been expected by the United States Central Intelligence Agency for almost seventy two hours before its launch, would set forth the largest and fastest U.S. troop movement since World War II.¹⁰³ Since the United States was on a friendly basis with both Iraq and Kuwait up until this point, there was a number of debates within the National Command Authority (NCA) as to what, if anything, should be done about this situation. After much debate, and to the surprise of even the members of the NCA who had not thought that a decision had been made on this matter, the issue was solved when on 5 August 1990, President Bush made his famous "... this will not stand, this aggression against Kuwait ..." speech.¹⁰⁴ With this unannounced speech, which came as a surprise to the Secretary of Defense and the Chairman of the Joint Chiefs of Staff, the stage was set for the military planning to begin.¹⁰⁵ The Persian Gulf fell under the Commander in Chief Central Command (CINCCENTCOM), General Norman H. Schwarzkopf, USA. Based out of Florida, CENTCOM was the newest of the Unified Commands and was probably the least ready for a regional crisis, a crisis which was occurring half the world away.¹⁰⁶ To make matters worse, only a small number of United States Navy and Air Force personnel were actually stationed in the Persian Gulf at this time, and the U.S. only had a small administrative support

unit on Bahrain as its only permanent base within the SWA-AO. After numerous meetings between the NCA and General Schwarzkopf, the stage was set for a trip to Saudi Arabia to persuade the Saudi leadership that Iraq was poised and prepared to continue its attack into their country. The conference between King Fahd and General Schwarzkopf started out very slow, and the pleasantries took up the majority of the time, until the topic of the visit was brought up, at which King Fahd became apprehensive that Iraq would continue the invasion into Saudi Arabia.¹⁰⁷ General Schwarzkopf asked for the permission of the Secretary of Defense Dick Cheney to show the King the satellite imagery of the Iraqi tanks lined up near the Saudi/Kuwait border, exactly as they had been the days prior to their invasion of Kuwait, that was all it took, and the permission was given to bring in U.S. forces onto Saudi Arabian soil.¹⁰⁸ Immediately upon leaving the meeting, General Schwarzkopf then looked over at General Chuck Horner, United States Air Force, who was the Air Force Component Commander for CENTCOM, and made the simple comment of "Chuck, start them moving" and with that began the largest and fastest deployment of military forces in the history of the United States, Operation Desert Shield, was under way.¹⁰⁹

United States Combat Forces and Equipment

The United States was at this time in history one of the best trained, best equipped, and most disciplined militaries in the world. After the robust years of the Reagan administration, the military was still in 1990 reaping the benefits of the money spent in the 1980s, rebuilding, refitting and equipping with the latest of technologies. The United States did not have the sheer numbers of personnel as did the countries of China, the Soviet Union, or for that matter, Iran or Iraq, which boasted the world's fourth largest army. The all-volunteer forces of the United States Military in 1990 only numbered the following active duty personnel: Army 761,100; Marine Corps 195,300; Navy 590,500; and Air Force 571,00.¹¹⁰ The strength of the United

States laid in the high-technological weapons, with which it was believed, that the advantage could be gained.

For the purpose of this thesis, only those weapons which affected the ability to defend the high value targets and ground forces of the United States from assault from the air will be addressed. The ability to defend against air attacks which had historically been from fixed-wing aircraft and helicopters, would now include that of the tactical ballistic missile (TBM). The defense against this type of attack, known as integrated air defenses (IADS), had been traditionally split between the aircraft which had conducted their form of air defense from combat air patrols and strip alert, to that of the close in defense of specific areas or assets by ground-based air defense units. This type of air defense would normally pitch aircraft against aircraft in air combat maneuvering (ACM), or what has been called *dogfighting*, while the ground-based air defense units who were deployed near their assigned or designated areas, would protect against any aircraft which would penetrate through the fighter CAPs.

The aircraft which were assigned this mission of air defense consisted of the F-15 Eagle which had a top speed of Mach 2.5, while able to also carry the sidewinder and sparrow air-to-air missiles. With a combat radius out to 790 miles, the F-15 was a formidable fighter and was touted by the United States Air Force as the world's best fighter.¹¹¹ The United States Marine Corps also had its own fixed-wing aircraft for dedicated use within their sector of the battle space, this aircraft was the F-18 Hornet. Able to fly from a fixed base, or off a carrier while underway at sea, the Hornet had a top speed of Mach 1.8, and a combat radius out to 340 miles.¹¹² With its ability to carry both the Sidewinder and Sparrow air-to-air missiles, the Hornet had much the same capabilities as those of the Falcon, both of which were more than a match for the aircraft which were flown by the Iraqi Air Forces.

Although the Iraqi's maintained a formidable air threat capability, the one threat that had stirred the ire of both the United States military and public was that of the Scud missile. The Scud was a threat capability against which the United States had no real ability to defend against. The United States had only one weapon which could possibly defend against the Scud, and that was the Patriot missile system. Originally designed in 1967 by Raytheon Corporation to defend against a fixed-wing and helicopter threat, it was accepted by the United States Army in 1985 for deployment with the forces.¹¹³ The Patriot system, which is typically deployed as a battery-firing unit consists of the AN/MPQ-53 radar, the AN/MPQ-104 ECS control van, and five launcher sections, each with the capability to carry and fire four PAC-2 missiles.¹¹⁴ The Patriot missile system has the advertised capability to detect aircraft out to 160 kilometers and the ability to engage an aircraft out to 80 kilometers.¹¹⁵ However, when the system is set to engage incoming tactical ballistic missiles (TBMs), the range at which it can detect and engage is extremely shorter than when engaging fixed-wing aircraft and helicopters. When set in the anti-TBM mode, the Patriot had only an unclassified engagement envelope from six-to-twelve miles when equipped with the PAC-2 missile.¹¹⁶ The Patriot has a 120-degree detection sector, and a 90-degree fire sector, which means that it does not have an 360-degree capability unless it is deployed as a battalion (five-to-six batteries).¹¹⁷ This meant that the number of active duty Patriot missile batteries which in June 1990 numbered only 44 manned batteries, and now split among 9 brigades, would be in high demand. Only the United States Army had the Patriot missile system, for the other American service which had its own ground-based air defense the Marine Corps did not have the Patriot.¹¹⁸ The United States Marine Corps' ground-based air defenses consisted of only the HAWK missile system, and that of the shoulder-fired Stinger missile. The HAWK which was originally developed and fielded by the United States Army in the late 1950's, was later adopted by the Marine Corps in the early 1960's. With the ability to

detect aircraft out to 100 kilometers, and engage these aircraft out to 40 kilometers, and up to an altitude of 39,000 feet, it was a formidable weapon for its time, and had been upgraded since that time to meet the changing threats.¹¹⁹ Software and hardware upgrades in the form of product improvement phases (PIPS) increased the abilities of the HAWK system. The HAWK system which was deployed to Saudi Arabia in the fall of 1990 was the Phase III variant, with improved digital screens, and numerous software upgrades, with a limited anti-TBM capability.¹²⁰ However, the Marine Corps and Army mainly employed the system to meet the fixed-wing and helicopter threats, with no HAWK designated strictly in the anti-TBM role.¹²¹ The Stinger consists of a shoulder-fired missile weighing only thirty six pounds, but with the capability to engage aircraft and helicopters out to four kilometers, and up to ten thousand feet.¹²² The Stinger which was employed by the Army and Marine Corps in the fall of 1990 was the reprogrammable microprocessor variant, with the capability to have the software chip replaced in a matter of minutes, to meet different threats in different environments.¹²³ This weapon system was normally employed in what is known as the manpads configuration, which consisted of a two man team of gunners, driving a flat bed HUMMVEE, with six missiles stored on racks in the bed of the truck. There was, however, a new variant also employed of this system, the Avenger, which had a gunner encased in an enclosed turret, armed with six Stinger missiles, a .50-caliber machine gun, and a forward looking infrared radar (FLIR) to assist in determining the range of the aircraft. The Army was the only service to employ this variant, for the Marine Corps had not yet fielded this system.¹²⁴

In addition to the weapon systems listed above, the United States Army also employed the Chapparral and Vulcan air defense systems. The Chapparral missile system, was designed in the 1960s, and consisted of a gunner encased in a glass enclosure mounted on a tracked vehicle; however, no Chapparrals were deployed into SWA before C+30. The Vulcan air defense gun

system was also employed in the theater by the United States Army. The Vulcan consisted of a 20-millimeter machine gun, a computer and radar control capability was mounted on the system, which could be used, or overridden by the gunner if so desired. This weapon system could also be used in the direct fire role against ground targets as it had been by the 82nd Airborne Division during the invasion of Panama in 1989, and would be once again during the ground war in Iraq.¹²⁵

The capabilities of the various aircraft and ground-based air defense systems were quite extensive, and intimidating to many of the United States enemies, but they would do no good if they could not get into theater quickly, and that is where the role of the United States Transportation Command, and its subordinate units would come into play.

United States Transportation Assets

The transportation assets of the United States military had been placed under the control of the United States Transportation Command (USTRANSCOM) starting in 1987, one of the eight unified commands. TRANSCOM would be responsible for providing the deploying units of the United States military transportation to the peninsula of Saudi Arabia in the fall of 1990. The types of transportation assets that TRANSCOM has control over consists of both air and sea-lift, and in some aspects, this includes the civilian as well as the military assets.

The means to transport the United States military by air is provided by the United States Air Force's Strategic Airlift Command flying C-5, C-141, and C-130 aircraft. The C-5 Galaxy is 247 feet long, with a 222 feet wingspan, and has the capability to lift 261,000 pounds of oversized cargo up to 3,405 miles without refueling at speeds up to 571 miles per hour.¹²⁶ The C-141 Starlifter is 168 feet long, with a wingspan of 159 feet, and has the capability to carry 94,508 pounds of cargo up to 2,935 miles without refueling and at speeds of 566 miles per hour.¹²⁷ The last of the military aircraft which was used to transport cargo to the Gulf was the C-130 Hercules.

This aircraft was 97 feet long, with a wingspan of 132 feet, and could carry 42,637 pounds up to 2,355 miles without refueling.¹²⁸ The two main limitations of the C-130 were that it was extremely slow being a four engine propellor aircraft, and that it had a shorter range when compared to the C-5 and C-141, and in comparison could only carry a fraction of the STONS. However, these limitations gave way to the fact that this aircraft could be used for intratheater lift, and could be landed on austere airfields with little external support. This capability was used when moving elements of the Vulcan and Stinger air defense elements of the 82nd Airborne Division north prior to the ground offensive. The capabilities of these numerous aircraft could be hindered by two major limitations, the endurance of these older airframes, and more importantly, the physical limitations on the crews.

Phase One of the strategic lift into the Southwest Asian Area of Operations (SWA- AO) began on 7 August 1990, and lasted until November.¹²⁹ During this time the military services would all fight each other for the limited amount of available lift, both by sea and more importantly by the air. The air lift capability of the Air Mobility Command only had a total of 109 C-5's and 234 C-141's to use for the military lift of the forces and equipment into the SWA-AO until such time that the Civilian Reserve Air Fleet (CRAF) aircraft could be called up and put into use.¹³⁰ With every one of the services wanting to deploy quickly into the SWA-AO for both military and political reasons, the amount of available lift was quickly overtaxed, and became exceedingly difficult to manage. The Time Phased Forces Deployment List (TPFDL) which was the standing plan from which to schedule units for deployment into the SWA-AO according to OPLAN 10-02 quickly went by the way side. The planning for the cargo lift also quickly went by the wayside, with the Air Mobility Command only capable of providing lift for an average 2,300 STONS of cargo daily, when the planning factor used to support this operation called for 2,800 STONS daily.¹³¹ The other problem with the air lift capability, was that

although the C-141 and C-5 had huge payloads, the basic payloads actually flown were 25% less than planned, thus creating another problem for Air Mobility Command.¹³² In addition to these problems, it was quickly noticed that the aircrews would be the greatest obstacle to being able to provide the amount of airlift needed, for the United States Air Force had regulations in place limiting the amount of flight hours that could be flown by crews. During a consecutive thirty day period, air crews were not allowed to accumulate more than 125 flying hours during 30 consecutive days, and no more than 330 hours during a set 90 day period.¹³³ In addition to this regulation, the Air Force had also in place a regulation which stated that air crews must not exceed more than 16 consecutive duty hours per mission, without crew rest.¹³⁴ By the third week of the deployment into the SWA-AO, the Air Force noted that crew members had “rapidly approached and exceeded” their 30 day flying hour limitation.¹³⁵ By C+45, TRANSCOM was 23 days behind the scheduled TPFDL, meaning that for every two days of scheduled lift during this time frame, the Air Mobility Command was falling one day behind.¹³⁶ The CRAF aircraft would need to be called up to offset the deficiencies of the military to transport the troops and equipment into the SWA-AO, and that was enacted on 17 August 1990 when 17 passenger and 21 cargo aircraft were made available to Air Mobility Command.¹³⁷ These 38 CRAF aircraft were the only ones used during Phase One of the deployment, until Phase Two was activated on 17 January 1991, the day the air war began. The reason for this late activation was that the commercial airline carriers who were tasked to provide the planes, had strongly lobbied Congress to wait until after the Christmas holiday period to call up the rest of the CRAF. On 22 August 1990 President Bush authorized the call up of 200,000 reservists, and by 25 August, just three days later, Air Mobility Command activated three C-5 reserve squadrons, and two C-141 reserve squadrons, approximately 20% of the strategic airlift reserve aircrew capability.¹³⁸ This reserve call up did not greatly effect the overall impact of the amount of forces which were transported

into the SWA-AO by C+30, which was 6 September 1990. Nonetheless, these reserve air crews would have an overall impact upon the conduct of the outcome of the war, for in this instance, it would not come for another six months.

The quick deployment of forces would be by the air, however, it would be impossible for the air assets to transport the heavy and outsized cargo by air to the SWA-AO, it would have to be moved by sea. The key to getting the sea-lift moving would have been to get the ships activated early, and to have the Maritime Pre-positioned Ships (MPS) to deploy early, but this was not the case, and although this idea had been pitched to General Powell, he turned it down in late July.¹³⁹ Thus, although the Marine Corps MPS ships deployed from their ports in Diego Garcia and the Mediterranean on 7 August 1990, they would not arrive until C+18, 24 August 1990.¹⁴⁰ Until these ships arrived, the United States ground forces in the SWA-AO had no armor, for the 82nd Airborne Division did not have armor, save the Sheridan, and the only other ground force in country by this time was the 7th Marine Expeditionary Brigade, and it was their armor that was on the MPS ships. Although two of the ships broke down during the voyage, 1.1 million square feet of outsized and heavy equipment was delivered, with the remaining two ships arriving before C+29. The United States Army's 24th Mechanized Division would load their equipment on the Roll-on-Roll of ships (RORO's) on 10 August, but with a 26 to 28 day ocean voyage before arriving in the SWA-AO, these forces would not make the C+30 deadline.¹⁴¹ Since the first of these ships did begin to get loaded until 10 August 1990 and due to the twenty three to twenty eight day transit to the SWA-AO, these ships did not play a significant factor in the initial buildup of forces by C+30.

United States Military Strategy

The United States military strategy for this operation would initially fall in line with the existing Operations Plan, OPLAN 10-02, now called Operation Desert Shield, the defense of the

Saudi Arabian peninsula. This would be accomplished by the rapid buildup of forces into the country of Saudi Arabia, which would be placed in a defensive posture, protecting the initial lodgement areas, until such time that offensive actions could be taken against the Iraqis if necessary. This plan of defending the Saudi Arabian peninsula would later change from one of defense to one of offense when the onslaught of Operation Desert Storm was launched to liberate Kuwait in January 1991, with the liberation of the country culminating on 28 March 1991.

United States High Value Targets

The United States would initially have to flow its forces into the existing air and sea points of debarkation, also known as APOD's and SPOD's, which were for the most part newly built, modern, and rarely used by the Saudi Arabian military. These APOD's and SPOD's would be the initial high value targets (HTV) which were to be protected from air and missile attack if the deployment of forces into the country, and defense of the peninsula was to be successful. The ability of these APOD's and SPOD's to not only receive the deploying forces and equipment, but to store much of the equipment and supplies, assisted to cut down the number of HTV which had to initially be protected. The major airfields were found in the cities of Riyadh, Dhahran, Damman, Jubayl and on the island of Bahrain.¹⁴² The SPOD's were initially only found at the ports of Damman and Jubayl, although later in the deployment after the first thirty days, major influxes of equipment and supplies flowed into other ports on the peninsula.

In addition to these HTV were the numerous HTV designated for coverage by the host nation of Saudi Arabia. These geopolitical HTV were both numerous and wide spread, reaching from the water desalination plants along the Persian Gulf, to oil refineries, to the palaces of Saudi and Bahrainian Royal families.¹⁴³ The amount of geopolitical HTV requested by the host nations were too numerous to all be covered by the Patriot and HAWK missile batteries of the United States, and thus discussions were held by General Schwarzkopf to accommodate as many of

these HTVs as he could. Due to the fact that the forces of the United States were the guests of the nation of Saudi Arabia, this political concession may be understood to some extent, but this was not understood by many of the troops while stationed in Saudi Arabia at the time. To further complicate the matter, there was no centralized direction from CENTCOM on how the HTVs were selected for protection by the Patriot batteries, and thus there was much confusion during the first thirty days as to what was to be considered a HVT for protection, and what could be left uncovered. This lack of attention in determining which HTVs were to be covered crossed service lines to the Marine Corps also, where the Commanding Officer of the only HAWK battalion in country supporting the Marines was relieved for cause by the Commanding Officer of the 7th Marine Expeditionary Brigade for issues concerning his meddling in determination of establishing a set list of air defense priorities.

Thus, it can be seen that no set lineal list of air defense priorities actually existed on paper as is doctrinally taught will happen, and thus there was much confusion as to what needed to be covered, and by whom. This problem was not service specific, and crossed all boundaries, even those of members of the coalition who believed that they were not getting their fair share of the air defense coverage, air defense coverage which was limited from the start.

United States Command and Control

Command and control was centralized for all United States forces under the Commander in Chief Central Command, who deployed with his operational headquarters into theater on 24 August 1990.¹⁴⁴ The CINC stayed in Riyadh, where a joint and combined headquarters was established with the Saudi's, and members from each of the services. The air forces and ground-based air defenses were, and still are to this day in debate on the issue of command and control. The problem is that the doctrine found within one of the service publications, will contradict what is found within one of the joint publications, and no consensus is can be reasonably found

on what exactly is the *answer*. This debate will continue, for the JFACC is considered a commander of the overall air forces by the Army and Air Force, where the JFACC is doctrinally viewed by the Marine Corps and Navy as a coordinator, vice a commander. In addition to this is the problem that Title 10 states the Marine Corps has control of its own aircraft assets and airspace, which does not fall in line with the Air Force, who had control of the JFACC in General Horner. This issue was not solved during the course of The Gulf War, and is still a matter of much debate, but needed to be mentioned in this text to show the difficulty of command and control during joint and combined operations.

Iraqi Combat Forces and Equipment

The Iraqi air and missile forces which existed at this time were competent and well trained and equipped in comparison to those in the surrounding countries of the Persian Gulf. However, in light of recent intelligence, and the outcome of The Gulf War it can be stated that these forces were not on the level of those of the United States.

The Iraqi air forces were equipped with numerous 718 fixed-wing aircraft and 517 helicopters, some of which were rated as top of the line.¹⁴⁵ The Su-24 had a top speed of Mach 2.8, and could deliver its 17,635 pounds of ordnance in all types of weather, day or night.¹⁴⁶ The Su-25 Frogfoot was typically used in the ground attack or close air support role, and could deliver its 9,700 pounds of ordnance 405 miles from its base.¹⁴⁷ The Mig-27 was the other fixed-wing ground attack aircraft that the Iraqis possessed, and this aircraft could deliver its 9,920 pounds of ordnance out to 240 miles.¹⁴⁸ All of these aircraft could deliver their ordnance payloads far enough south to reach both Riyadh, and Bahrain. The main attack helicopters that Iraq possessed at this time were the Mi-24 Hind, the Mi-8 Hip, and the Gazelle. The Hind could carry up to 5,290 pounds of ordnance and rockets out to 179 miles, and in addition could also carry a squad of troops or commandos.¹⁴⁹ The Hip was also designed for the dual role mission of

being able to carry troops, in addition to 6,614 pounds of ordnance and rockets out to 286 miles.¹⁵⁰ The Gazelle was French made, and was capable of carrying its wire guided missiles and rockets out to 220 miles.¹⁵¹ The combination of these three types of helicopters and the fact that Iraq possessed almost 500 of these and other types, made this threat a very real one to the Coalition forces, and in particular, the ground forces which would have to invade into Iraq and Kuwait.¹⁵² In addition, the Coalition forces were also concerned about the possibility that Iraq would use these helicopters, in combination with a commando strike against the HTVs of the Coalition forces. The Iraqis also had an unknown number of unmanned aerial vehicles, or remotely piloted vehicles, similar in performance to those of the United States, and used these vehicles during the air war to gather intelligence on the Coalition ground forces. The Iraqis used an RPV which was made by the French, and was able to perform its missions over a wide area, and during different units and positions during the same flight.¹⁵³ This RPV was used during the course of the war, flying missions along the Saudi and Kuwaiti border, and on different occasions targeted the 1st Marine Division Main Command Post, and the 7th Marine Air Control Squadron north of Ras Al Mishab. Although these RPV's were visually acquired, and tracked by Stinger teams, deconfliction problems with the TACC disallowed any possibility to launch against them until they had already crossed back over the berm into Kuwait. Thus, although these weapons were used on different occasions, no engagements were authorized out of fear of fratricide.

The TBM was the most politically, and emotionally charged of the weapons with which Iraq was prepared to, and did use during this conflict. Relatively unheard of by most of the general public, and most of the military for that matter before Operation Desert Shield, the term Scud quickly became a household word. The Scud was originally designed and manufactured in the 1950's by the U.S.S.R as a tactical and strategic weapon capable of delivering conventional,

biological/chemical and nuclear payloads. The variants that the Iraqis were using in the fall of 1990 were the Al-Hussein, and the Al Abbas. These two missiles initially started as a basic Scud-B, and then had improvements made to them to increase their range and speed.¹⁵⁴

Both of these long-range variants could deliver their payloads to the cities, ports and airfields of Saudi Arabia, Bahrain, and Israel. The following missiles were used by the Iraqis during Operation Desert Storm:¹⁵⁵

<u>Missile</u>	<u>Range (km)</u>	<u>Length (ft)</u>	<u>Warhead (lb)</u>	<u>CEP (m)</u>
Scud-B	300	37	2,000	1,000
Al Hussein	650	39	1,100	2,000
Al Abbas	900	44	770	3,000
Laith	60	30	500	2,000

*The circular area probable is the distance from the target within which 50 percent of the missiles fired will land (CEP).¹⁵⁶

Although, as was stated earlier, the Scud was designed as tactical and strategic weapon of mass destruction to be used on the battlefield, this is not how the Iraqis decided to use this weapon during the war. The target of the scuds during this war would not be the military forces of its opponent, but the civilian populace of those countries which were its enemies. A modern long-range terrorist weapon was now to be found on the battlefield. Although the impact of the scuds capabilities would not directly affect the outcome of the military operations, nonetheless, the ability of the scud to potentially break up the coalition could have been catastrophic. In addition to these missiles, Iraq also possessed a number of shorter range tactical missiles and rockets which they used continually throughout the war. The Frog-7 (Laith) was used, as were

the Astros-II rockets which attacked the Marines for eight straight nights in the northern part of Saudi Arabia , west of Ras al-Mishab in late January.

The combination of these weapons, showed the potential that Iraq had to inflict excessive amounts of casualties upon the coalition forces if they had the will to have done so, which fortunately for the Coalition forces they did not.

Iraqi Transportation/Resupply Assets

The Iraqis had very little in the way of transportation and resupply assets, and it is this reason that did not carry their attack into Saudi Arabia during August of 1990 before the Americans arrived in the country.¹⁵⁷ During the time frame leading up to the start of hostilities in January 1991, the Iraqis were able to resupply their forces in southern Kuwait, but once that air war began on 17 January, this capability stopped. The Americans were able to stop through air interdiction the ground resupply efforts of the Iraqis, and what little amount of supply came by low flying helicopters into southern Kuwait during late night flights was negligible. Thus the Iraqi transportation and resupply assets did not have a positive effect on the outcome of the war for the Iraqi forces.

Iraqi Military Strategy

The Iraqis had just completed fighting a long and costly war with the Iranians from 1981 until 1989, and their Soviet style tactics had been adjusted to fight the type of static war with which they had fought against Iran. The Iraqi military strategy had been one in which they would make limited gains, and then go on the defense, allowing for a strong defensive system of inter-locking battalion and brigade size units, with which they would draw the enemy into, and subsequently destroy them.¹⁵⁸ In addition to these inter-locking defensive units, the ability to interject their fixed-wing aircraft and attack helicopters would be used. These aircraft would

initially be kept in *nuclear hardened* shelters during the first portion of the hostilities, and then used at the commanders discretion to annihilate the enemy. There are many who have speculated why the Iraqis who possessed the number of combat aircraft they did, never really used them during the Gulf War, and the answer to this may never be found. But during interviews with captured Iraqi officers, they stated that they had only expected that Coalition's air war to have lasted a matter of seven to ten days, and then the ground war would begin, during which they expected to have launched their own aircraft against the coalition.¹⁵⁹ This explanation as to why the Iraqis had not launched their aircraft is the most probable. The Iraqi's were simply caught off guard by the Coalition's lengthy air campaign, which means that the threat of future air attacks is still very much a possibility, and one that the United States cannot just disregard because it was not attacked during this conflict. The defensive posture that the Iraqis took up in southern Kuwait during the fall of 1990 is also reminiscent of the fact that the Iraqis did not believe the United States would actually use force coming to the aid of Saudi Arabia, or to extricate them from Kuwait. This may be traced back to a conversation between April Gallespie, the United States ambassador to Iraq, and Saddam Hussein on 25 July, 1990 just six days before the Iraqi attack into Kuwait when Gallespie told Hussein that the United States "... had no opinion on the conflicts like your border disagreement with Kuwait ..." and that it was an *Arab problem*, which the United States would stay out of.¹⁶⁰ The sentiments of the Secretary of Defense and the Chairman of the Joint Chiefs of Staff also reflected this philosophy, and as discussed earlier, it was not until President Bush's unscheduled comments in Colorado in early August that the die was cast for what would eventually carry the United States into war. This consequence was not necessarily in the overall Iraqi strategy, but one that they would have to deal with during the next eight months, and one that they deal with to the present day.

Iraqi's High Value Targets

The Iraqis, much like the United States, placed emphasis on their command and control facilities, airfields, and supply dumps as HTVs. In addition to these assets, the Iraqis also placed an emphasis on their missile launching capabilities, something that the United States did not have, but one which the Iraqis used extensively throughout the war, more a weapon of terror than a real strategic threat, nonetheless, a power which they possessed, and one which needed to be protected from air attack. Unlike the Coalition forces however, the Iraqis had a tendency to place these areas which would be considered HTVs very near schools, places of worship, and schools which housed children. This posed a significant problem to the planners of the air campaign for the Coalition forces, for collateral damage was something which they would have liked to be kept at a minimum. In addition, the Iraqi ground-based air defense units which were providing the protection for these assets also established themselves very near these same places of worship, hospitals, and schools, and at times directly on the roofs of these same buildings.

Iraqi's Command and Control

The Iraqi command and control structure was very rigid, and extremely centered, thus allowing for very little flexibility by the subordinate commanders. In addition to this was the Iraqi reliance on wire communications when in the defense, a wire communications system which was quickly severed by the vast amounts of air and artillery ordnance which was delivered on the Iraqi defenders, thus leaving them cutoff from direction from higher headquarters. The ability of the Coalition air attacks to assist in achieving a quick and decisive victory are evident here, and without which a immeasurable amount of more casualties would have been inflicted upon the Coalition forces.

Operation Desert Shield

With the decision made by President Bush to deploy forces, and permission given by the Saudi's on 7 August, we see the fastest and largest movement of U.S. forces in history.¹⁶¹

Operation Desert Shield called for the initial forces to protect the lodgement areas, the APODS and PODS within Saudi Arabia for the follow-on forces to get into country quickly and safely.

Although this task affected all of the services, the responsibility for accomplishing this task would fall mainly on the shoulders of the 82nd Airborne Division, the 7th Marine Expeditionary Brigade and the F-15 squadrons of the United States Air Force. The initial fly in of ground

forces consisted of the DRB-1, the designated 2nd Brigade of the 82nd Airborne Division which left the *Green Ramp* of Fort Bragg, North Carolina on 8 August, and the lead elements of the 7th MEB which arrived in Saudi Arabia on 10 August.¹⁶² These ground forces immediately took up

defensive positions, with the 82nd mainly in the vicinity of Riyadh, and with some forward elements as far north as the port at Jubayl. The Marines of the 7th MEB immediately secured, and began defending the port of Jubayl in anticipation of the imminent arrival of the MPS ships which had been dispatched from Diego Garcia six days before.¹⁶³ The fighter and attack

squadrons of the Air Force had flown into Dhahran and were available to provide a limited air counterattack capability against an Iraqi ground offensive into Saudi Arabia, and combat air patrol (CAP) missions in conjunction with the E-3A AWACS which had arrived in the SWA with the F-15's.

The airlifts of the follow-on forces of both the 82nd AB, and the 7th MEB were slow in arriving into the theater due to a concerted effort of all the services to get their units manifested for flights into the SWA-AO, regardless of the TPFDL. In addition, numerous problems existed with the amount and types of equipment, and supplies that each of the units were bringing into the theater, and this again placed a strain on an already over-taxed airlift capability. Many of the units were bringing in nonessential equipment and supplies, such as

clothes washers and dryers, air conditioner units and other amenities when the emphasis according to the TPFDL was supposed to have been *trigger pullers* capable of protecting the lodgement areas for the onslaught of follow-on forces. This strain was obviously effecting all of the units involved, and the ground-based air defense was not excluded from this air lift constraint. The first limited ground-based air defense in country was that of the Stinger and Vulcan teams within the 82nd AB, and the Stinger teams of the 7th MEB under the 3rd Low Altitude Air Defense Battalion.¹⁶⁴ However, it became readily apparent that having assets in country and prepared for combat was significantly different between the two services, and this led to an overconfidence on behalf of the expeditionary forces who thought that they actually had a Stinger umbrella protecting them during this time frame. In actuality, nothing could have been farther from the truth, for although there were Stinger teams in country, two factors influenced the employment on these assets, the heat and humidity, and the reaction of the local Saudis to this influx on United States military forces who they believed were not needed for protection. The 82nd AB had only plotted potential firing positions for its Stinger teams on the map at Hall Camp 5, and in all actuality did not have them deployed to those positions, because in the words of one of their officers, "it is too hot to expect them to be out there all day," so the teams were housed in air conditioned trailers in the base camp, and would be directed to take up firing positions if the Iraqis were to attack over the border.¹⁶⁵ The problem with this is that the Iraqis would only have to fly south approximately fifteen minutes to attack the airfield and port of Jubayl, while it would take the Stinger teams of the 82nd AB over twenty minutes to deploy to their assigned firing positions, thus there was in effect no real low altitude air defense being provided by the teams of the 82nd AB. Although the heat and humidity did not stop the deployment to firing positions for the Stinger teams in country of the 7th MEB, they deployed within hours of arriving to positions within the port facility of Jubayl, other problems quickly

came about. These problems were two fold, in that although the Stinger teams did immediately deploy to firing positions within the port, they were not allowed to deploy outside of the confines of the port itself, for the Saudi nationals did not want the Marines outside of the port, which may have at this time in the deployment, alarmed them to the fact that a invasion was possible. In addition, problems were also encountered from within the ranks of the Marines themselves, with the resistance to the deployment of Stinger teams at all to protect the port by the assistant operations officer of the 7th MEB, who stated that there was no need for Stinger teams, and that all the 7th MEB needed “ . . . was to park an Aegis cruiser out there (in the harbor) . . . ” and that would be enough air defense for the Marine contingent.¹⁶⁶ Obviously, the lack of knowledge of employing weapons systems with which they were unfamiliar could have been catastrophic, for the Aegis cruiser has no capability against low flying aircraft, and that in fact, all of the Aegis cruisers that the Navy had at this point in the deployment were already protecting assigned Navy assets. The 7th MEB requested and received permission for the sole defense of the Jubayl port and airfield, and the 82nd AB relinquished this responsibility on 25 August.¹⁶⁷

The flow of United States forces continued into the country at a steady rate, although it was slower than planned, and this affected all of the services. The first Patriot unit to deploy into the SWA-AO departed El Paso, Texas on 12 August. This Patriot battery, Bravo Battery 2-7, from the 11th ADA Brigade, would be operational on 15 August, and would initially protect the the APOD at Dhahran.¹⁶⁸ By the end of C+30, the 11th ADA Brigade had only this one Patriot battery in country and ready and operational. The remaining six Patriot batteries would not arrive in country until 14 and 16 October, after C+60. This was due to the fact that these Patriot assets had to be deployed by sea-lift, for TRANSCOM was already behind on the airlift of assets into the SWA, and a typical Patriot battalion needed 301 C-141 aircraft equivalents to get into theater.¹⁶⁹ Bravo Battery would be protecting one HVT by itself, which means that this type of

employment was contradictory to the air defense principles listed in FM 44-100. The follow-on batteries would also be stretched extremely thin, in that it was not uncommon to find only one or two batteries covering a vital area, which proved to be ineffective and against published doctrine. Nonetheless, the deployments continued, for the Army, and a total of 21 Patriot batteries would be deployed to the Saudi Arabia. An additional six Patriot batteries would be deployed to Israel, and two to Turkey, for a total of 29 batteries, or approximately sixty six percent of the manned batteries in the Army's inventory.¹⁷⁰ During the initial thirty days, the arrival of the first elements of the Marine Corps HAWK batteries were seen, and they became operational, usually within twenty four hours of their arrival. A Battery and limited battalion headquarters support from the Second Light Antiaircraft Missile Battalion of Yuma, Arizona, deployed on 20 August, arrived the 21st, and had one platoon operational on 22 August.¹⁷¹ The second platoon was emplaced and operational by 23 August, and the follow-on battery, B Battery, was deployed on 22 August and operational by 24 August.¹⁷² With the exception of follow-on Stinger teams from the Army and Marine Corps, the one Patriot battery, and the two HAWK batteries were the entire ground-based air defense assets in the SWA-AO by the end of the C+30 window. These assets were only providing coverage for three HTVs, approximately one twentieth of what would be covered by the start of the war on 17 January, 1991, and much less than would be identified for coverage by the CENTCOM and Saudi Arabian staffs.

Operation Desert Storm

With all of the diplomatic means exhausted, the Coalition forces launched the air war on 17 January 1991, and the first reported launch and intercept of an Iraqi Scud missile occurred during a still widely disputed incident on the night of 18 January 1991. A Battery, of the 11th ADA brigade showed the symbol of an incoming Iraqi scud, and fired the first Patriot missile of the war, which the Patriot battery's computer scored as a *probable* intercept.¹⁷³ General

Schwarzkopf proclaimed to the world on live television that this was the first *kill* of an Iraqi scud during the nightly CENTCOM press conference the next night.¹⁷⁴ With this statement, and the subsequent firings and breakups of the incoming scuds, the legend of the Patriot missile was born. However, this first engagement would be quickly discounted as a system anomaly, meaning that the Patriot computer produced an erratic symbol for a Iraqi missile that never actually existed. The first of 81 actual scuds Iraq launched would be fired during the course of the war, and these were launched against mostly geopolitical targets in both Saudi Arabia and Israel.¹⁷⁵ The launching of the Iraqi scuds was repeatedly met by the firing of Patriot missiles, an almost nightly news event, seen by the entire world, including Iraq. These intercepts purportedly showed the multiple launches of Patriot missiles and followed by what appeared to be a showering intercept. In actuality, long after the war these *intercepts* were the subject of great debate, and still are to this day. According to a various reports published in 1991 and 1992, the Patriots were not always achieving actual intercepts, because the modified Scuds were breaking up into numerous pieces upon reentry into the earths atmosphere. According to the GAO report, the intercepts ratio was only nine percent, vice the ninety six percent proclaimed by President Bush, or the United States Army's claim of seventy percent.¹⁷⁶ Although the scuds were reportedly being intercepted at a ninety six percent ratio in Saudi Arabia, which was later proven to be grossly overestimated, this was not true for those scuds which were launched against Israel. The scuds being launched against Israel were causing more damage, injuries and deaths than were considered acceptable by both the military and civilian sectors, thus causing an extreme strain on the relations between the United States and Israel.¹⁷⁷ The United States did not want the coalition to be affected by the introduction of Israel in to the war, which would have possibly split the coalition along religious lines. The United States deployed Patriot batteries to protect those geopolitical HTVs in Israel, for there were no coalition HTVs within Israel for political

reasons. These purely geopolitical HTVs were extremely important to the civilian and political sectors of both the United States and Israel. With the continuing scuds attacks against these HTVs, and the fact that 80 to 100 percent were exploding in the cities without being intercepted, the Israeli government became extremely vocal in asking for more protection, and the pressures mounted for *something* to be done.¹⁷⁸ A Israeli diplomatic mission was sent to the White House stating in effect that if the scuds did not stop, that the Israeli's would be forced to attack Iraq, thus almost assuredly destroying the coalition which had taken seven months to build. Thus, President Bush declared that the "darndest search and destroy mission ever undertaken" would be launched by both air and special forces to locate the mobile launchers from which the scuds came.¹⁷⁹ Iraq was initially thought to have had only sixteen mobile TELs, but as the war progressed, so did the intelligence estimate, which grew to an estimated thirty six launchers. Colonel Glasson had originally proclaimed that the might of the F-15 Eagle was such that with only one squadron of twenty four planes, he could guarantee the neutralization of the scud threat.¹⁸⁰ However, this boast was quickly dissuaded as the Scuds did not stop coming, and the amount of aircraft on *Scud hunts* quickly increased. The political implications from the launching of this forty-year-old weapon of terror, was such that the Secretary of Defense demanded and received daily reports as to the number of *Scud hunts* performed, the number of aircraft being used in these hunts, and the results of every one of the flights. This problem reached the point that General Horner proposed to General Schwarzkopf that all strategic flights being made against Iraq be stopped for a three day period during which every aircraft available, approximately two thousand in all, be flown around the clock on *scud hunting* flights. However, when General Schwarzkopf learned that this would put the air campaign back a proportional amount of time, he quickly rejected the idea, but it can be seen the amount of power which the launching of the scud possessed. In addition to this was the fact that although there were three

times the amount of aircraft that Colonel Glasson had originally set aside to neutralize the scud threat, not a single mobile scud launcher was destroyed by these aircraft or the special forces of the United States and Britain which had also been dispatched for this cause.¹⁸¹ The worst of the scud attacks against Saudi Arabia occurred on 25 February 1991, when a scud flew through the Patriot screen unscathed, and detonated on a hangar which was housing newly arrived Pennsylvanian National Guardsmen, killing twenty eight, the worst one time loss of coalition personnel during the course of the war.¹⁸² Although this area had been identified as a HVT, and was protected by Patriot missile batteries, including A Battery 2-7, it did not intercept the missile. An investigation conducted after the incident revealed that the battery had been shut down during this period due to maintenance, which needed to be done after every eight hours of operation.¹⁸³ This particular battery had been operating for over one hundred continuous hours before shutting down, and it was during this time that the scud was launched.¹⁸⁴ Although there were other batteries operating in the area, they did not fire on the missile due to its trajectory being outside of their capability to engage it. This scud launch was the last of the war against Saudi Arabia, and undoubtedly the most destructive. As stated earlier, eighty one scuds were launched during this war, resulting in numerous deaths and personnel being wounded, and untold damage to both military and civilian structures.

The launching of the scuds was suspected by Coalition intelligence to have been followed by the launching of air attacks against both military and geopolitical targets, although this threat never actually materialized. There were initial Iraqi air defense flights during the first part of the war against the coalition aircraft in Iraqi airspace, and the flying of some limited low level helicopter flights in both Iraq and Kuwait, but only one of these ever crossed into Saudi Arabia during Desert Storm. This incident occurred on the night of 24 January 1991, when a flight of two Iraqi Mirage F-1's flew past the northern gulf cap which was being manned by two

Saudi Arabian F-15 fighters, and proceeded down the Saudi Arabian coast almost thirty miles before being intercepted by the coalition fighters near the coastal town of Ras al-Mishab.¹⁸⁵

Although the Iraqis had actually flown over the border between Kuwait and into Saudi Arabian airspace numerous times during the first portion of operation Desert Shield, this was the only recorded intervention of Saudi airspace during the war itself.

The war ended quickly, after a combination of forty-one days of air strikes, and only one hundred hours of ground combat, but the lessons learned from this war would be debated for years to come.

Importance of Operations Desert Shield and Desert Storm

The importance of Desert Shield and Desert Storm as relating to the issue of ground-based air defense can be broken down into four major areas: that air defenses (both air and ground-based) need to be sent into the AO as soon as possible; that a new breed of weapons held by emerging countries of the world cannot be discounted; that these countries which possess this capability will use them during a conflict; and that the United States was unable to provide adequate air defense against these weapons during the initial lodgement phase from C+1 to C+30.

The United States was unable to get adequate amounts of air defense into the SWA-AO during the first thirty days of Operation Desert Shield. The amount of ground-based air defenses in country and prepared for combat operations by C+30 was inadequate to cover the amount of HTVs designated by CENTCOM and the Saudi's. In addition, the amount of air transportation assets (airframes and aircrews) that the United States possessed during this period was inadequate to get the amount of designated forces into country by the prescribed closure dates required by CENTCOM.

There existed during this time the knowledge that these new and emerging weapons were possessed by Iraq, and that this fact was not given the amount of consideration which it needed. This was seen when the United States Air Force proclaimed that it would only need twenty four planes with which it could neutralize the scud threat, and yet after two thousand sorties had failed to destroy even one mobile TEL.

The United States believed that although Iraq may use these weapons to some extent, that the government underestimated the amount of use these weapons would see, and the amount of political strain it would place on the coalition.

Lastly, the United States with all of its technological superiority could not provide adequate air defense against a missile which was almost forty years old. Although this missile was old, could only carry a one thousand pound warhead, and was inaccurate, it could make it unscathed to strike its assigned target, and the United States did not have the ability to stop it. In addition, that although the United States could deploy ground-based air defense assets to the SWA-AO, it could not in all cases properly employ them in accordance with established doctrine. Even if it could have employed the ground-based air defense assets in accordance with established doctrine, that not enough ground-based air defense assets exist to cover every area that was designated as an HVT during the course of this war.

Comparative Approach

This portion of the analysis will be broken down into three parts: Similarities between the two case studies; Dissimilarities between the two case studies; and an analysis of the current capabilities of the present day military.

Similarities

The similarities between the two case studies were numerous, and quite unexpected. The similarities that were found between the two case studies were in the areas of: the amount of political infighting between the services before the conflicts; a lack of adequate transportation to get the required amounts of ground-based air defense to the AO in the amount of time required; a disregard for the established and published employment doctrine; too many HTVs designated for coverage than was practicable; the belief that airpower could do it all; and the drastic drawdowns which occurred after the two conflicts.

The first area that was similar between the two case studies was that of the amount of political infighting which occurred during the periods leading up to the conflicts. During the period before World War II, the United States military saw numerous instances of political infighting between the services which made up the military. This was evidenced by the attempts of the Army to disband the Marine Corps, or make it an amphibious division under the Army, much like the proposal that was fielded in the late 1980's which proposed the same thing. In addition to this was the attempt by General Billy Mitchell to place all of the United States' airpower under one service, much like the Air Forces' proposals during the 1980's and early 1990's to disband the idea of *four separate air forces*, and place them under the guise of one service. These ideas were common to both of the case studies, and are currently present to this day, thus once again posing a potential problem for the proper integration of the services during future conflicts. This is important in that the United States military services need to work together, especially in times of drawdowns, for they all have a common goal, the protection of the United States and its interests. However, this has not been the case in the past, and is currently again seen as a problem, such is happening with the competition between the Army and Navy for the lead service's position in the THAADs project. Until this type of infighting is

overcome, and the problems associated with it, a truly joint military will never exist in this country, and that will hurt every aspect of the United States economy, from the ordinary taxpayer, to the businessman, to the individual service member.

The second area that was found to be similar during both of the case studies was the inability of the transportation commands to get the required amounts of assets into the AO by the time designated in the plan. During the battle for Guadalcanal the Navy Task Force under Admiral Turner departing the AO before the required amounts of assets were delivered for use by the expeditionary forces. This problem of having the designated transportation get the required amounts of assets into the AO was again seen during Operation Desert Shield. The airlift and sea-lift transportation assets which were assigned to USTRANSCOM were unable to keep the timeline established in OPLAN 10-02, and quickly fell behind the required STONS to be transported. Air Mobility Command was unable to keep up the pace required to due to a lack of crews and aircraft. The crews quickly out flew the amount of hours they were allowed before a designated rest period was required, thus slowing down the flow of personnel and equipment into the AO in a timely manner. By C+45 Air Mobility Command was already 23 days behind schedule, with substantial amounts of personnel and equipment obviously not making the required C+30 window for this thesis. The ability to transport the required personnel and equipment never did meet the requirements as set forth in OPLAN 10-02, and was one of the factors which led to the decision of higher commanders to violate the employment doctrine of the ground-based air defense units. This is important in that the United States cannot project the type and amount of combat power abroad that it wants. More importantly, the enemies of the United States may discover this fact, and attack the United States forces early and in the lodgement area during the next expeditionary operation, causing untold amounts of damage and numerous casualties. The enemies of the United States cannot be counted on to allow the

buildup of forces in a prelude to war as did the Iraqis during Operation Desert Shield, our enemies are intelligent, and learned as many lessons from The Gulf War as we did, and maybe more.

The third area that was similar between the two case studies was the fact that during both of the case studies, the forces neglected to use the established and published doctrine on how to employ the ground-based air defense assets. During the battles for Guadalcanal and the Central Solomons we constantly see the expeditionary forces initially employing single guns to provide air defense protection for HTVs, when the current doctrine stated that there existed a need for a mix of weapon calibers and capabilities, and a need for either overlapping fires or mutual support from other guns. These tenets were neglected, to the detriment of those assets which were supposed to have been covered, for the enemy aircraft could still successfully attack them, and did, until the follow-on ground-based air defense assets came into the AO. During Operations Desert Shield and Desert Storm the employment doctrine was again neglected, proving that this lesson was not learned during the fifty years between the two conflicts. The initial deployment into the SWA-AO of only a single Patriot battery was against the published doctrine which stated that Patriot should be employed as a battalion, providing mutual support and overlapping fires for the HVT. However, this was not the case, for this single battery was deployed by itself for almost sixty days, until the rest of the battalion deployed into the SWA-AO in mid October. This single battery should have been only doctrinally operational for eight to ten hours before shutting down for maintenance, yet this one battery was operational for up to one hundred hours at a time without conducting the proper maintenance on it. The battery was shown during the course of the thesis to have had an error rate of over twenty percent developed within it after operating continuously for over twenty four hours, thus rendering it unable to intercept any incoming Scud missiles which may have been launched during this time. The deployment of a single Patriot

battery can only be seen as a political move, for it certainly was not a sound military move, in that the deploying unit and its higher commanders must have surely known that this one battery could not have provided the proper amount of coverage needed during this time in the deployment. This type of disregard for the published doctrine can be followed throughout The Persian Gulf War, and is evident when only a single battery is deployed to protect the port of Jubail, vice the battalion which was required by the doctrine and size of the HTVs in that area. The reason for this disregard is probably due to the desire of the senior commander to provide some sort of ground-based air defense coverage for a HVT, vice making the tough decision to properly employ the system, and leave some HTVs uncovered. Whether this was due to political pressure from the Host Nation's government, or internal military pressures, the fact remains that this disregard for the established and published doctrine was again observed. This disregard for the doctrine directly played a part in the deaths of the twenty eight Pennsylvania National Guardsmen, who were not protected by doctrinally employed Patriot batteries, batteries which, due to their limited numbers and numerous responsibilities, had been operational for over one hundred continuous hours. The numerous HVTs designated for coverage by ground-based air defense was also a key to this problem of not following the published doctrine. This is important in that these decisions to follow the published and established doctrine were probably promulgated from the inability of the transportation commands to get the required amounts of assets into the AO, and this led to the placing of single weapon systems to do the work of four or five. This directly corresponds to the decisions by the higher commanders to cover almost every designated HVT with some sort ground-based air defense system vice making the hard decision, whether politically incorrect or not, and leave some of the HTVs uncovered, while adequately covering the important ones. This type of indecision led to the disregard for the established and proven doctrine, and will continue in the future, for the United States cannot transport enough

assets into the AO within the first thirty days to cover every asset which will be designated as an HVT for military or political reasons.

The desire to have numerous assets designated as HTVs by the senior commanders for protection by ground-based air defense assets was similar in both of the two case studies. During Guadalcanal and the Central Solomons we see a desire to protect not only the landing area, but also the ships in the harbor, the airfields, the command posts, supply dumps, etc. . . This attitude of attempting to protect everything by designated ground-based air defense assets was again evident during Operations Desert Shield and Desert Storm. In addition to providing protection for the ports and airfields, supply areas, ASP's, and command posts, there was also a strong desire to provide designated ground-based air defense coverage for the palaces of the Host Nation's Kings and numerous Princes. These HTVs were too numerous for the amount of ground-based air defense assets which were designated for deployment and operations in the AO, and were never downsized, only added to, as was the case of the HTVs in Israel as the operations continued. This problem will only continue to get worse with the growth of geopolitical HTVs designated for protection by ground-based air defense assets when coupled with the inability of the senior commanders to make the decision to properly protect only a few HTVs in accordance with the doctrine, vice attempting to inadequately cover all of the HTVs.

The last area of similarities that was found between the two case studies was that of the drawdowns of the military which occurred immediately after the conflicts. Directly after World War II we see a drastic drawdown in the size and composition of the military forces, much like those drawdowns which were conducted after Operation Desert Storm, and are occurring again during this time in the nation's history. This is important in that the United States will continue to draw its military forces down to the point that they will not be able to react to a potential conflict without significant call up of the Reserves and National Guard. This type of lengthy call

up will directly hurt the United States in the conduct of future expeditionary operations, and will again show to it's enemies a lack of ability to project combat power abroad quickly and efficiently.

Dissimilarities

Although the two case studies occurred almost fifty years apart, it was a surprise to the author to see the small amount of dissimilarities that existed from one case study to the other, in comparison to the amount of similarities which were found. The two main dissimilarities which were found when comparing the two case studies were: type of enemy air threat; and the decrease in the amount of what would be considered acceptable losses by the United States civilian population during the two conflicts.

The enemy air threat during the battle for Guadalcanal and the Central Solomons was from manned airplanes, or what is referred to in present day language as the air breathing threat (ABT). Although the threat that was anticipated during Operation Desert Shield was from a combination of the ABT and the TBM, the TBM was the only threat that materialized which offensively attacked the ground forces of the United States and the Coalition. This is in stark contrast to the threat which was found during battles for Guadalcanal and the Central Solomons during World War II. Although the threat to the military was not that overly substantial, the emotional impact that the TBM had upon the civilian populace of the countries of Saudi Arabia and Israel was massive. The amount of geopolitical assets designated as HTVs for coverage by Patriot units were evidence to this fact, as was the amount of media coverage that this weapon system produced. This forty year old ballistic missile produced one of the most emotional topics of the war, and one which will continue to do so in the future. This is important in that those third world countries which would like to possess the power of a large and expensive air force, can now do so with the purchase of the TBM. The TBM is an inexpensive weapon in

comparison to an large air force in that it does require the money to train, house and pay pilots, nor does it require the amount of maintenance that a fleet of aircraft does. In addition, the TBM will fly through all types of weather, day or night, and will not decide not to fly, or to defect as did the pilots of Iraq did in 1991. The TBM and the cruise missile will be the weapon of choice for the enemies of the United States in the future, a weapon which will be used for the political and military advantage more often than the United States is currently prepared to handle at this point.

The other dissimilarity which was found between the two case studies was the amount of casualties the American public would find as acceptable. During the battles of World War II the civilian populace became desensitized to the massive casualties which were incurred during the push to rid the world of the nation's enemies, were as during the Gulf War the loss of the twenty eight soldiers to one Scud was seen as a tragedy. This is not to make light of the loss of twenty eight lives, just the opposite, it shows the importance that human life has to the people of the United States, and the belief that those lives should be protected by all means possible. However, the means to adequately protect all the lives of the expeditionary forces from TBM's is unrealistic, and will not happen, even though it will be expected by the American public which believes that future wars will all be as bloodless and technically successful as that of The Gulf War. In addition, the people of the United States will themselves become expectant of coverage against the newer and longer range TBM's currently being produced by China and North Korea, coverage which is years and many billions of dollars away.

An Analysis of the Current Capabilities of the Present Day Military

The United States has undergone a reduction of forces since the time of Operations Desert Shield and Desert Storm, and these reductions will effect the ability to conduct expeditionary operations throughout the world in the years to come.

Currently in the United States Air Force, there are only 104 C-5 and 178 C-141 aircraft in its active inventory, in comparison to the 109 C-5's and 234 C-141's that were on active service at the start of Operation Desert Shield.¹⁸⁶ This represents a twelve percent decrease in the availability of lift assets, even considering the fact that there are an additional twenty of the newly fielded C-17's on active service in the Air Force today. In addition to these problems, is the fact that the C-141 airframes were designed to operate up to 25,000 hours each, however, the average C-141 on active service currently has 36,000 hours on it. The C-141 airframe has out flown its designed lifetime, and with continued use past the planned 25,000 hours, losses of aircraft and crew can be expected to increase.

Although the advertised capability of the PAC-3 missile will be greatly increased in comparison to the ATBM capability of the PAC-2 missile, it will not be available until the year 1999. The United States Army has completely eliminated the HAWK battalions which were on active service at the time of the war, and no replacement for them is scheduled for fielding. This leaves the United States Army even less able to defend the same amount of HTVs it attempted to protect during the Gulf War.

The United States Marine Corps has also drastically downsized its ground-based air defense assets from the time of The Gulf War. The number of active HAWK batteries has been reduced to two, vice the seven which were on active duty at the start of the Gulf War, with no less amounts of assets to cover. This downsizing represents a seventy two percent reduction of the HAWK batteries, which were all deployed to Operation Desert Storm, and yet were not enough to cover the HTVs designated. In addition, the number of active service Stinger batteries has been reduced from six down to five. This represents a seventeen percent reduction in the amount of short range air defense for the Marine Corps, which had a total of five batteries

deployed to Desert Storm, and these five batteries could not cover the HTVs designated for protection.

The United States Air Force has also reduced the number of its fixed-wing fighter squadrons by twelve squadrons, assets which are vital to the United States being able to field an integrated and capable air defense system.

In addition, the ability of the United States Navy to lift soldiers and Marines by sea on amphibious ships has drastically declined since the end of The Gulf War, with the loss of the Newport Class LST's, of which there are none left from the seventeen which were on active service at the start of the war.

Currently the United States is again facing a series of force reductions that will effect its military, a military which has seen an increase in the number of missions during the last six years, to go along with an increase in the number of air threats to the United States military.

Currently today there are over twenty thousand fixed-wing aircraft, and combat helicopters in the world, with several thousand ballistic missiles spread amongst twenty plus countries that could be used against United States forces, and our military is being reduced, thus continually widening this gap.

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CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

This thesis used a combination of two case studies, those of the Solomon Islands Campaign of 1942-1943 and Operations Desert Shield and Storm in 1990/1991, and a comparative analysis to come to the conclusions expressed in this chapter. This chapter will answer the primary thesis question, as well as the three subordinate questions, and also present a set of recommendations to deal with the dilemma that is presented by the thesis' conclusions.

Conclusion(s)

Primary Question

In the age of deficit reductions and a downsizing military, will the United States be able to provide adequate ground-based air defense coverage during joint expeditionary operations ?

After careful analysis of the data uncovered during the research, it is the conclusion of this thesis that the United States cannot provide adequate ground-based air defense during joint expeditionary operations. The United States could not provide adequate and integrated ground-based air defense during the first thirty days of the joint expeditionary operations of the Solomon Islands Campaign of 1942-1943, nor that of Operations Desert Shield and Storm in 1990-1991. The United States possessed a significantly higher ratio of ground-based air defense assets to the number of HVTs during those periods than it does presently and yet failed to provide adequate protection for the joint expeditionary forces in both of the case studies. In both of the case studies, the number of successful enemy air attacks in either the form of aircraft as during

Operation Watchtower or TBMs as was the case during Operation Desert Storm were unacceptable to both the higher headquarters and the general public. Currently, the United States public has become accustomed to a conflict in which there will be no casualties, and the loss of even a single life becomes a matter of national debate, as was the case during Somalia in 1993 when the United States Army Rangers lost eighteen men during a single firefight. This attitude will continue to prevail, and the United States public will demand the need to know how and why these losses were incurred, what could have been done to alleviate them, to ensure that they do not happen again. The United States public's belief that the combination of our Air Force and Army Patriot Missile batteries will be able to protect against any enemy air attack will be shattered if the United States is attacked by a determined enemy air attack. The two case studies proved that not only was the United States unable to provide adequate ground-based air defenses during the period from C-Day to C+30, but at all during the entire length of the two operations. The two case studies also proved that there was not enough ground-based air defense assets in the inventories at those times, and after the last iteration of drawdowns we see a continual reduction of ground-based air defense assets in all of the services which possess them. In addition, neither of the ground commanders in the two case studies had all of the HVTs protected that they had wanted by designated ground-based air defense assets, HVTs which grew in number throughout the examinations of the two case studies. The bottom line is that the United States has not been able to provide adequate air defense coverage by ground-base air defense assets, nor will it be able to in future conflicts.

The Three Subordinate Questions

Does the United States possess the ability to transport the desired amount of ground based air defenses into the area of operations within the desired first thirty days of deployment ?

This thesis also shows that the United States does not have the ability to transport an adequate amount of ground-based air defense assets into a theater of operations during the first thirty days of the operation. In each of the two case studies the research showed an inadequate amount of lift for the amount of forces deploying into theater within the first thirty days of the joint expeditionary operations. In addition, the United States possessed a significantly larger amount of transportation in the active forces than is currently available to the forces of the United States military today. The recent drawdowns of personnel and transportation assets such as the loss of the Newport Class LST and the reductions of the numbers of C-141 assets, will directly influence the ability of the United States to project military force into any theater within a timely manner. In addition, the number of operational hours on the aging C-141 fleet means that a drastic decrease of intertheater airlift will be departing the active component in the next four years. The bottom line is that the United States military will not be able to project adequate ground-based air defenses into theater within the first thirty days of an joint expeditionary operation with the current amounts of air and sea list in the inventory.

Do the ground-based air defense systems currently in the United States inventory possess the capabilities necessary to counter the threat from the air to the lodgement force during the first thirty days?

The United States does not possess the amount of ground-based air defense to counter the growing threat to its forces in a joint expeditionary operation. The growing threat is from the TBM and cruise missiles that are currently found in over twenty nations of the world, and the United States does not have the ability to adequately protect its forces from these weapons. The Patriot Missile system does have a nominal capability against the TBM, but as shown during the Operation Desert Storm case study, this capability equated to only a 9 percent kill ratio, which is unacceptable. The new PAC-3 missile will have an increased capability against this type of

threat; however, the PAC-3 will not be fielded until the turn of the century, which is still three years away. During this time the countries of the world will be working on making their TBM's faster, and of longer range, thus possibly making the PAC-3 missile somewhat obsolete before it is even fielded. The United States Marine Corps currently has the HAWK ground-based air defense system, which has a limited capability against the shorter range TBMs,(FROG-7 type), but the Marine Corps only possess two batteries of this weapon system on active duty, with a distinct possibility of these two batteries being eliminated in the future during more anticipated drawdowns. Thus it is the conclusion of this thesis that the United States does not have capability in it's current inventory to adequately counter these new threats to its expeditionary forces.

Is the current published doctrine still viable after the latest drawdowns and the changes in the air threat found in the world today ?

Lastly, the current doctrine is still sound, but has not been properly used in the past, and probably will not be used again in the future due to the lack of sufficient ground-based air defense assets, and the growing number of HVTs being designated for protection. This thesis showed that the published doctrine during both of the case studies was not always used due to the desire to protect HVTs with some form of ground-based air defense, inadequate as it was. This desire to neglect the published doctrine does not mean that it is unsound, however, the limited amount of ground-based air defense assets will not allow the doctrine to be utilized without leaving a significant number of HVTs uncovered by designated ground-based air defense assets. The air defense principles and guidelines were shown during the examination of the two case studies to be sound, and of use for current and future operations against an enemy with the ability to interject his will upon the forces of the United States through the use of his air or missile capabilities. The bottom line is that the United States must find a way to use the proven and

published doctrine, with the amounts of ground-based air defense assets in the current inventory. In addition, the commanders must realize that there will have to be a number of HVTs which will go unprotected by ground-based air defense assets in the future, and that they will have to live with this decision.

Recommendations

The following recommendations are only meant for consideration to solve some of the problems identified during the course of this thesis, and should not be considered to be all encompassing:

That the ground-based air defense community must educate the higher commanders of the joint expeditionary forces on the true capabilities and limitations of the weapon systems which will be providing protection to the lodgement and follow on forces. The senior commanders must not be allowed to believe that just because there is a single Patriot or HAWK battery in the vicinity of a HVT that it will be able to provide continuous and ample coverage for that HVT. The research conducted during this thesis showed that there had been a tendency for the capabilities of a weapon system to be exaggerated, as was the case of the Patriot during Operation Desert Shield/Storm, when this was not the case. In addition, the ability of airborne assets to locate and destroy mobile TEL's cannot continue to be exaggerated, for this will only lead to false assumptions of security on the part of senior commanders of the expeditionary forces.

That the United States must continue to develop ground-based air defense systems which will be able to counter the threat posed by continually improving TBM's and cruise missiles, as is currently happening with the THAADs program and the Navy's upper tier program. In addition to this is the fact that the United States must continue to improve its current ground-based air defense systems which it possess in the inventory to include protection against the

shorter range TBM's and cruise missiles which will pose a very real threat to the forward echelons of the ground forces.

That the United States Air Force must continue to field, and expedite the procurement of the C-17 as a replacement for the aging transport fleet which is currently incapable of transporting sufficient amounts of forces and their equipment and supplies into the theaters of operations. In addition, the United States Navy must continue to field the new LPD-17 as the replacement to the now retired New Port Class LST's. The bulk of combat power will continue to be projected by sea lift, a capability which will be lacking until this class of ships is completely fielded after the turn of the century.

Lastly, that the United States Marine Corps seriously reconsider the doctrinal concepts of the FEZ, MEZ, and WEZ. These doctrinal concepts were sound when there was a sufficient number of HAWK and Stinger assets in the inventory, however, this is no longer the case, and this concept must be reviewed. Marine Air Weapons and Tactics Squadron-1 (MAWTS-1) must take the lead on how to publish a sound and current doctrine which will accommodate the fact there are only two HAWK batteries in the current inventory. It is the opinion of this author that the two remaining Marine Corps HAWK batteries be used in a designated anti-TBM role, and to have the Marine Corps fighters provide air defense coverage over the designated AOA, with the exception of BDZs or above designated maneuver units. The Marine Stinger teams would provide point defense for the maneuver units and designated HVTs where BDZs would be established. The Stinger teams assigned to these maneuver units or BDZs would be required to provide ground-based air defense from ground level to approximately 8,000-10,000 feet, above which the fighters would have priority of engagement of the enemy. This recommendation is not in-line with the currently published Marine Corps doctrine, but does employ the air defense principles and guidelines. The Army currently has fifty-one Patriot batteries; however, the

Marine Corps only has two active duty HAWK batteries. Perhaps it is time that the realities of the current situation are taken into consideration, for two batteries cannot adequately support the currently published FEZ, MEZ and WEZ system.

The Marine Corps must revise its current doctrine as soon as possible. With the growing numbers of TBMs and cruise missiles found in countries hostile towards the United States and its allies, it is just a matter of time before these weapons or others like them will once again be used against forces of the United States.

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Wilkenson, Greg, LtCol. USMC, Phone Interview by the Author, 17 January, 1997. Lieutenant Colonel Wilkerson is a experienced and highly regarded Marine Corps air defense Officer, with extensive HAWK experience, currently serving as the Executive Officer of the 1st Light Anti-Aircraft Missile Battalion at MCAS Yuma, AZ. LtCol. Wilkerson's experiences during The Gulf War were used for portions of this thesis, as well as information he had acquired as to the future of HAWK within the United States Marine Corps.

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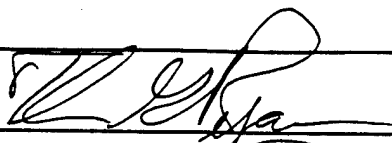
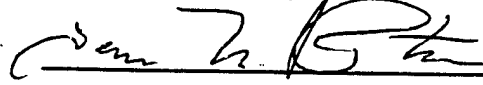

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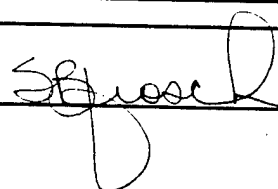
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